

YOGA RESEARCH FOUNDATION: VOLUME FOUR

Application of Yoga 2000–2009



Yoga Publications Trust, Munger, Bihar, India

Application of Yoga 2000–2009

With kind regards, ॐ and prem

Sriani Niranjan

YOGA RESEARCH FOUNDATION: VOLUME FOUR

Application of Yoga 2000–2009



Yoga Publications Trust, Munger, Bihar, India

© Yoga Research Foundation 2019

All rights reserved. No part of this publication may be reproduced, transmitted or stored in a retrieval system, in any form or by any means, without permission in writing from Yoga Publications Trust.

The terms Satyananda Yoga® and Bihar Yoga® are registered trademarks owned by International Yoga Fellowship Movement (IYFM). The use of the same in this book is with permission.

Published by Yoga Publications Trust
First edition 2019

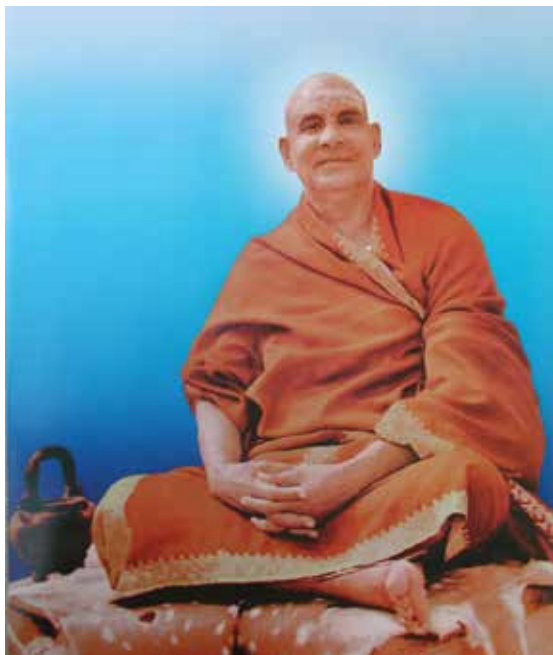
ISBN: 978-81-940805-5-8

Research conducted and compiled by Dr Swami Nirmalananda

Publisher and distributor: Yoga Publications Trust, Ganga Darshan,
Munger, Bihar, India.

Website: www.biharyoga.net

Printed at Thomson Press (India) Limited, New Delhi, 110001



Dedication

*In humility we offer this dedication to
Swami Sivananda Saraswati, who initiated
Swami Satyananda Saraswati into the secrets of yoga.*



Dedication

*To our guru Sri Swami Satyananda Saraswati
who continues to inspire and guide us
on our yogic and spiritual journey.*

Contents

Preface	<i>ix</i>
Introduction	1
Understanding Statistics	4
List of Abbreviations	10
Research on the Application of Yoga	
Yama and Niyama	13
1. Yama and Niyama, 2003–2004	16
Yoga and Education	24
2. Yoga and Adolescent Students, Chennai, 2009–2010	27
Inconclusive Research	
I: Promotion of Health	
1. Diabetes Study, 2000	41
2. Diabetes Mellitus, 2006–2007	
Summary Report of Research Study	44
Research Study	48
Appendix: Teaching Schedule for BHEL Project	77
II: Basic Research	
1. Shatkarma – Jala Neti, 2001	83
2. Shatkarma – Physiological Effects of Laghoo Shankhaprakshalana (LSP) versus Laghoo Shankha- prakshalana with Kunjal and Jala Neti, 2002	87

3. Classical Asanas, 2002–2004	92
4. Sheetal Pranayama, 2001	114
5. Moola Bandha, 2004	119

III: Research on Application of Yoga

1. Yoga and Puberty, 2004–2009	129
2. Pre-examination Anxiety and Memory in Adolescent Students, 2008–2009	146
Kirtan	152
3. Kirtan, 2004	156
Appendix A: Kirtan Questionnaire (Translation)	169
Appendix B: Kirtan Questionnaire – Scoring Guide	171
Appendix C: Kirtan Questionnaire (Original)	175

Preface

Yoga Research Foundation was founded by Swami Satyananda Saraswati in 1984, in Munger. The aim of the institution was to investigate and validate the many aspects of yoga, its techniques, practices and postulates in a scientific manner.

Already in 1977, Sri Swami Satyananda had established the Research Co-ordinating Centre with the same idea and purpose. One of his major contributions in the field of yoga was to introduce yoga to the world of medical and scientific research. Yoga was no longer to be a secret science for sadhus and ascetics, but accessible to one and all. The benefits of yoga are not only a reality experienced by the individual; they can be measured, monitored and analyzed with the most sophisticated scientific equipment available.

Sri Swami Satyananda initiated a worldwide movement of yoga research which carried out projects at hospitals, psychiatric clinics, colleges and universities.

On the occasion of the 14th Foundation Day of Bihar School of Yoga, on 24 January 1977, Swami Satyananda Saraswati addressed a gathering at Sivanandashram in Munger, announcing the creation of the Research Co-ordinating Centre. The following is an excerpt of the address he delivered:

People are coming to Munger from all over the world in order to learn yoga, not only Hindus but people from all religions and walks of life. Today, everyone

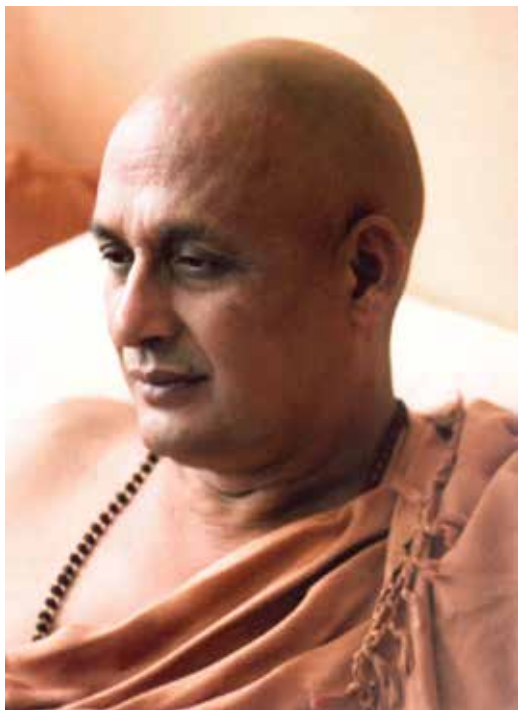
from king to beggar is perplexed, restless, and wants to learn yoga to concentrate the mind, in order to find peace and free their body and mind from disease and tension. This is why our small ashram is transmitting the message of yoga to the whole world.

Many of my sannyasin disciples are doctors, engineers, philosophers and psychologists. Being highly trained, they have a basic understanding of the scientific yogic research going on around the world. Through them whatever research is being done on yoga, East and West, will be brought here, collated and conveyed in a readable form to the people. Our aim is to convey information about the investigations going on in the world. How are alpha waves produced while singing kirtan? How does japa influence blood pressure? What is the effect of relaxation on the mind? What does science have to say about yoga? Over the last five hundred years we have forgotten our yogic culture and spiritual knowledge has nearly disappeared. Today, however, there is a great yogic renaissance going on around the world and spiritual knowledge is again manifesting.

Finally, to all yoga lovers I express the wish that they may share their knowledge and experience with us in the form of assistance and cooperation, so that we can impart this knowledge to the maximum number of people through our new research coordinating centre.

Yoga Research Foundation continues to this day to uphold the vision of Sri Swami Satyananda. Research is carried out at Ganga Darshan, in India, and by centres around the world. The effects of yoga practices are under investigation, as well as the impact of certain yogic practices and yogic lifestyle on physical and mental imbalance. The invitation which Sri Swami Satyananda extended to the scientific and yoga communities remains open, and all are welcome to share their knowledge, understanding and findings of their research into yoga.

MESSAGE FROM SRI SWAMI SATYANANDA TO YOGA RESEARCH FOUNDATION



Yoga Research Foundation was founded in 1984 and now in 1989 the projects and plans which we had envisaged are finally taking a dynamic shape.

I am confident that the Yoga Research Foundation will provide a scientific interpretation of the practices of yoga. Research conducted all over the world has amply indicated this possibility.

Although I am not personally present on this occasion, my thoughts and my spirit are always with the activities of the Foundation, for this is one dream I have cherished.

Swami Satyananda

Introduction

Yoga Research Publications Volume 4, Application of Yoga 2000–2009, presents research projects and studies carried out between 2000 and 2009. The idea of this volume is to encourage readers to engage in research into *yoga vidya*, the vast treasure of yoga: its philosophy, its understanding of human nature and life, the well-defined methods, the systematic approach to the multitude of yoga practices, and the distinct goal prescribed for each of the branches of yoga discipline.

Part 1 of this volume contains two projects on the application of yoga. In the study on the yama and niyama of raja yoga the subjects practised and observed one yama and niyama. They were guided in their practice and in keeping a spiritual diary over a period of four or eight months. The second study was with school children in Chennai and yielded encouraging results.

Part 2 contains a selection of the many studies undertaken by Yoga Research Foundation, pertaining to the areas of Promotion of Health, Basic Research and Application of Yoga. These studies do not present any significant results. The research failed to prove any of the hypotheses proposed or could not be concluded at all. The intention is to show a sample of the variety of research undertaken and the reasons why no valuable or significant outcome could be recorded.

Two studies on diabetes mellitus (DM) were carried out. One looked only at the behaviour of blood sugar, and the second one explored a great variety of parameters. The research on hatha yoga practices focused on the shatkarma jala neti, a selection of asanas, sheetali pranayama and moola bandha. Not all suppositions could be explored or proved.

Two research projects are dedicated to the physical, mental and emotional dimensions of school-going children and the influence yoga can have on their wellbeing. Research at one school consisted of three practices only. The children were taught daily surya namaskara, nadi shodhana pranayama and Gayatri mantra. At a second school, the children were introduced to a wider range of practices. In both cases the results were inconclusive.

The last study on kirtan, a practice of bhakti yoga, examines six emotional states and three experiential states. The study lasted for seven days only.

Some of the research projects were carried out at Bihar Yoga Bharati and Bihar School of Yoga, Munger, Bihar, others in Indore and Bhopal, Madhya Pradesh.

Yoga Research Foundation decided to publish the present selection of inconclusive research to draw attention to the many variables that constitute research. The best project, well designed and thought through, will not yield results if, for example, subjects are not interested or the duration of the research is inadequate to prove any hypothesis. Here are some of the reasons for the poor and inconclusive fallout of the studies:

- the duration of the study was too short;
- the duration of the study was too long; frequent change of yoga teachers at school over a five-year period had a negative impact on the project. The initial interest could not be maintained by new teachers. Teachers and children were not motivated.
- inadequate training of the research team and/or yoga teachers;
- insufficient number of subjects;

- heterogeneous group of subjects, for example; insulin dependent and non-insulin dependent participants in the same group.
- inability to measure the chosen parameters.

These shortcomings did not deter Yoga Research Foundation from further research projects. On the contrary, they were steps on the path of learning, improving and succeeding. The concept of 'trial and error' is valid for research on yoga as much as for any research carried out anywhere in the world. Yoga Research Foundation hopes that this volume will inspire yoga practitioners and yoga teachers to explore the benefits of yoga and share their discoveries with other yoga aspirants and the public at large.

Today, proof and evidence are a necessity. Whether a consumer product or a personal discipline such as yoga, people want to know: 'Does it work?' The medical community, educationalists, corporates and sectors of public service worldwide declare an interest and a need for change.

Yoga might just be the answer they are looking for. If the claims of yoga can be substantiated with research, society will throw its doors wide open for yoga to enter and become an integral part of people's life and lifestyle.

Many years ago Sri Swami Satyananda Saraswati predicted the need for the science of yoga when he announced:

People from every field are discovering that yoga should be introduced into every stratum of society to enable everyone to restructure their mind and personality. The most important task is to expose more and more people to the benign influence of yoga. All over the world people are suffering, whether they are financially secure or living in poverty. Everyone is striving for peace of mind and happiness, but this will only come when they are exposed to yoga and begin to know a little more about the person within.

Understanding Statistics

Statistics are a play of numbers. One should know how to interpret the numbers. If wrongly presented to a person with little knowledge of statistics, the reading will lead to wrong conclusions.

The following brief description of terms is meant to help the layperson understand the intricacies of statistics as used by Yoga Research Foundation.

RESEARCH DESIGNS

Pre-post design: The same set of subjects are observed for a given parameter (example: blood pressure) before and after an intervention (example: 5 rounds of surya namaskara at medium speed). The observations are then compared using appropriate statistical methods.

Repeated measure trial: The subjects are observed once or more frequently during the trial period and not only at the beginning and end of the trial.

Controlled trial: One group of subjects are observed for a given parameter before and after an intervention; another similar group of subjects are observed in the same way but without any intervention. The two groups are then compared using appropriate statistical methods.

The first group is known as the experimental group (also known as yoga group in studies conducted by Yoga Research Foundation). The second group is known as the control group. The control group instead of having no intervention in some research studies may have another comparable intervention (example: asana versus physical exercise).

Random controlled trial: The subjects are assigned to either the experimental group or the control group at random, not selectively.

BASIC CONCEPTS

Hypothesis: It is a statement that describes the expected result of a research study (example: regular practice of ten minutes of ujjayi pranayama will reduce systolic pressure by 10 mmHg in a hypertensive person).

When the expected results of a research study are not specific they are called the ‘aims’ of the study (example: effects of ujjayi pranayama on blood pressure in hypertensive subjects).

Null hypothesis: It is a hypothesis that is directly counter to what one hopes to show (example: stressed individuals do not differ from normal individuals in aberrant behaviour).

Sample size (n or N): This refers to the total number of subjects under observation.

MEASURES OF ANALYSIS

Mean score: It is an arithmetic average of a set of scores.

Percentile: It refers to the point below which a specified percentage of observations falls.

Median or 50 percentile score is the score corresponding to the point having 50% of the observations below it when

observations are arranged in numerical order. Therefore, if scores were to be arranged by ranking, the mid-point ranking is the median.

25 & 75 percentile scores is the score corresponding to the point having 25% & 75% of the observations below it respectively when observations are arranged in numerical order.

Standard deviation: It is a score that depicts how individual or group scores are dispersed around the mean score; the smaller the standard deviation, the more closely clustered the scores are to the mean score, or the more uniform the group.

A high standard deviation score indicates that individual scores differ widely from each other.

When calculating significance, the standard deviation is used as the denominator (divisor). Therefore, the higher the denominator, the greater the nominator is needed to get the same result. That means that if the standard deviation score is high, a greater degree of change is needed in the individual scores to make the result significant.

Significance: This refers to the probability with which a hypothesis might be rejected when it is in fact correct. In other words, the significance level indicates that there is insufficient reason to believe the hypothesis is incorrect.

The smaller the number, the greater the significance. Usually a significance value of 0.01 or 0.05 or less is acceptable. It means that there is 1 (or 5) in 10,000 chance of the concerned hypothesis to be wrong when actually it is correct.

Factors influencing significance

1. Actual difference in values between two observations: There is a direct influence between the difference in values and significance. Therefore, the greater the difference between the pre-reading and the post-reading, the higher will be the significance.
2. Magnitude of the sample variance: The degree to which the individual observations differ from each other. There

is an inverse influence between the difference in values and significance. Therefore, the greater the sample variance, the less significant the results.

3. Sample size: There is a direct influence between sample size and significance. Therefore, the larger the sample group the greater the significance.

However, this can be misleading. If the sample size is enormous, a small change will be shown as significant. For example, in a group of 600 subjects with high blood pressure the reduction of blood pressure from 158 to 156 mmHg will be shown statistically as significant, but clinically it is insignificant and means nothing to the doctor or patient.

Similarly, if the sample size is too small, a moderate change can be statistically insignificant but indicate a useful change. Indeed, the study must be repeated with a larger sample to come to a final conclusion.

4. Chosen level of significance: Usually it is either 0.01 or 0.05. The lower the chosen level of significance, the better the probability that the hypothesis is in fact correct.

Magnitude of effect

To nullify the effects of influencing factors a measure called 'magnitude of effect' is calculated. It is a measure of the degree to which variability among observations can be attributed to interventions. It is a measure used to counteract violations in assuming significance.

'Eta squared', 'Omega squared', 'Effect size' are some of the statistics used to measure magnitude of effect.

Yoga Research Foundation uses 'Eta squared' to express the magnitude of effect. The higher the value of 'Eta squared', the more relevant is the result. A value that is greater than 0.2 is considered acceptable.

Methods of determining significance

1. *Student's t test (t test)*: It is used in pre-post type research designs involving two groups of subjects.

One-tailed t test: The one-tailed t test rejects only one tail of data distribution, the extreme lower end. It is used with homogeneous samples, in cases where the data is more or less equally distributed along the bell graph/on both sides of the mean value.

Two-tailed t test: The two-tailed t test rejects extreme results on both tails of data distribution. It is used in cases where the mean and median are very close together.

2. *F Value:* It is commonly used when repeated observations are made over a period of time for a parameter in a sample. In such cases it is calculated using a general linear model, repeated measures. In such cases it is also used when the experiment involves more than two groups, e.g. yoga group, exercise group, no intervention group. It is calculated using ANOVA (Analysis of variance).

The cut-off value of F statistic at which the hypothesis is accepted (in technical terms, the null hypothesis is rejected) depends upon degree of freedom (df). Then after computation it is expressed as significance.

Degree of freedom (df): It is usually taken as one less than the number of observations in the sample.

3. *Analysis of variance (ANOVA):* This is a statistical technique for testing differences in the means of several groups, not just two as in the t test.

Power: This is the probability of correctly accepting a valid hypothesis (in technical terms, correctly rejecting a false null hypothesis). It denotes the reliability of the findings. The value 1 shows 100% reliability, 0.5 shows 50% reliability. A very good reliability or power is 0.8 and above.

DISPLAYING DATA

Bar graph: This is a graphical representation in which the frequency of occurrence or quantity of different variables on the X axis (horizontal axis) is represented by the height of the bars.

Line graph: It refers to a graphical representation in which the Y axis (vertical axis) values corresponding to different values of the X axis (horizontal axis) are connected by a line. In this way its use is the same as the bar chart. It is also useful for time-series data.

Boxplot graph (box and whisker plot): It is a graphical representation of the dispersion and variability of a sample. The lower hinge of the box denotes 25 percentile, the upper limit or hinge, 75 percentile and the middle line 50 percentile or median.

Components of a Boxplot graph

1. *H-spread:* It refers to the area between the two hinges (the actual box).
2. *Hinges:* They are those points that cut off the bottom and top quarter of a distribution. They display the middle 50% of the scores.
3. *Whisker:* It is the line extending from the upper and/or lower hinge representing observations less than 25 percentile or more than 75 percentile. A whisker is not longer than 1.5 times the H-spread.
4. *Outlier:* It is an observation lying outside the limit of the whisker. In the research studies conducted by Yoga Research Foundation all outliers have been hidden from the graphs.

LIST OF ABBREVIATIONS

n	number of subjects in a research study
BMI	Body Mass Index or Basal Metabolic Index
SBP	Systolic Blood Pressure (blood pressure during rhythmical contraction of the heart)
DBP	Diastolic Blood Pressure (blood pressure during dilation of the heart and arteries)
Kg/m ²	kilogram/square metre (e.g. body weight in kilogram divided by height in metre squared)
mmHg	millimetre of mercury (Hg), unit used to express blood pressure
h/o	history of
DM	Diabetes Mellitus
HBP	High Blood Pressure
Std dev	Standard deviation
mg%	milligram %
NIDDM	Non-Insulin Dependent Diabetes Mellitus
Blood sugar F & PP	Fasting & Post Prandial (two hours after a meal)
Bl. Glu. F	Blood Glucose/Sugar Fasting
Bl. Glu. PP	Blood Glucose/Sugar Post Prandial (two hours after a meal)
HbA1c	Glycosylated Haemoglobin (blood test showing overall control of blood sugar over a period of three months just prior to the test)
HDL	High Density Lipoprotein, a component of cholesterol
LDL	Low Density Lipoprotein, a component of cholesterol
IHD	Ischemic Heart Disease (heart disease due to inadequate coronary blood supply to the heart)
ICMR	Indian Council of Medical Research

Research on the Application of Yoga

Yama and Niyama

TRAINING AND PERFECTION

The eradication of vices and the development of certain virtues form the first step on the ladder of yoga – the yamas. Disciplining your nature and forming a steady and pure character through a set of right habits and daily observances is the next step – the niyamas.

Yama is the very foundation of yoga, without which the superstructure cannot be built. Practice of yama is really the practice of *sadachara*, right conduct. The noble eightfold path of Buddha deals with the practice of yama only. Great emphasis is given in every chapter of the *Bhagavad Gita* to the practice of yama. In every religion you will find this to be the foremost teaching.

Niyama weeds out all evil traits and implants godly qualities. Niyama regulates habits, and aims at giving the spiritual aspirant mastery over his behaviour. Instead of being a slave to habits, he now controls his conduct and develops certain habits by determined will. The practice of niyama is for the purpose of purifying the mind of its impurities and destroying distractions.

Yoga serves as the only solution to all universal problems. All methods of yoga have ethical training and moral perfection as their basis.

—Swami Sivananda Saraswati

PRATIPAKSHA BHAVANA – PREPARING THE PATH FOR YAMAS AND NIYAMAS

During the practice of yama and niyama, passions come up due to old habits, negative tendencies and so on, and they create disturbances. Suppression will not do. The best thing is to ponder over the opposite tendencies. Thus hate is to be won over by love because they are the opposite of each other. So when there is *vitarka*, or disturbance due to negative thoughts, students should practise pratipaksha bhavana.

For example, if one wants to be honest, one sometimes sees that dishonest people succeed in life, while honest people meet with failure. This may give rise to the negative thought that one should also be dishonest. This is vitarka; it is the wrong side of the argument. When this wrong side is advanced by the mind, it creates a disturbance and may mislead the aspirant. In this situation the opposite of dishonesty, which is honesty, should be cultivated through pondering over it. This is called *pratipaksha bhavana*.

Sometimes an individual does not practise violence himself, but he may have it done through others, or he may tolerate it being done by others. This is to be avoided in yoga because one is held responsible even when one tolerates violence or has it done through others. This also applies to other vitarkas such as falsehood and theft.

Sometimes these vitarkas are done due to greed, anger or confusion, but all of them must be avoided. The vitarkas may be mild, medium or intense, but they must be wiped out, irrespective of their cause, intensity and effect. All these negative passions beget two things ultimately – pain and ignorance. When pratipaksha bhavana is introduced, the mind overcomes negative passions, a positive complex is formed, and then the aspirant can follow the spiritual path of yama and niyama without difficulty.

—Swami Satyananda Saraswati

THE ROLE OF YAMA AND NIYAMA

You think of asana and pranayama, the physical aspects of yoga, as the catalysts to lead you to a different state of mind. It is not going to happen. You think of meditation and mantra as the catalysts to develop a better mind. It will not happen. Until and unless you think of incorporating little changes in your life, fine-tuning your life, you will not live the change. This fine-tuning can be done through yama and niyama.

For his work on raja yoga Patanjali selected only yamas and niyamas relating to managing the vrittis of mind. However, every yogic branch, whether hatha yoga, bhakti yoga, karma yoga, kundalini yoga or chakra sadhana, incorporates within it a reference to yamas and niyamas that are relevant to the attainment of perfection in that particular yoga.

Patanjali's yamas and niyamas reflect management of the mind, not management of life, not management of crisis situations, not management of emotional changes, not the behavioural aspect.

You continue to follow the same patterns of thinking and behaviour. There is no acceptance of anything different. You continue to express the same weaknesses and shortcomings. So, how do you change that? Meditation cannot, it has not until today. So what will help to further change? A change in lifestyle, which allows you to wash away the old and accept the new, will bring about change.

This washing is of the mind, and it can be done with the practice of yama and niyama, for they help to change the samskara, the basic conditioning of human nature.

Yamas and niyamas have existed in yogic literature prior to Patanjali and will continue to exist even when humanity has changed. They are the eternal principles that define the positive traits in life, representing a culmination of the human effort to experience beauty, peace, bliss, truth and expansiveness in life.

—Swami Niranjanananda Saraswati

Yama and Niyama, 2003–2004

Summary

Observing one yama and one niyama over an extended period of time (4 to 8 months) brings about positive changes in one's personality. The attitude and outer behaviour are expressed with sharper awareness, better discrimination and simplicity of character. These changes are highly significant (0.000) within the subjects (pre-post) and between the two groups (experimental and control group).

Introduction

Each branch of yoga has its own set of yamas and niyamas which help the practitioner to attain the goal of that branch of yoga. Yama and niyama form the basis of every spiritual tradition. Without them no one can progress on the spiritual path. Swami Niranjanananda identifies them as part of 'attitudinal yoga'.

The first two steps of the eight-step path of Sage Patanjali's raja yoga are yama and niyama. The five yamas of raja yoga are: *satya*, truthfulness, *ahimsa*, non-violence, *asteya*, non-stealing, *brahmacharya*, judicial use of the sense organs, and *aparigraha*, to possess only what is necessary. The five niyamas are *shaucha*, cleanliness, *santosha*, contentment, *tapas*, austerity, *swadhyaya*, study of one's self, and *ishwara pranidhana*, surrender to the higher Self. When a person tries to cultivate these qualities, a transformation takes place in the personality, in the interactions with fellow beings and with the environment as a whole. Balance and harmony permeate everything.

Yoga Research Foundation (YRF) was working with a large student population of Bihar Yoga Bharati (BYB) observing the positive transformation taking place due to the yamas and niyamas introduced as positive qualities into the life of the students. It has to be kept in mind that the study

was carried out in an ashram environment which exerted its own influence on the students. Ultimately, the research focused on three sequential changes that could occur: awareness, discrimination and simplicity.

A questionnaire entitled 'Psychological Disposition' was designed containing these three components. As the students observed one yama and one niyama and kept a spiritual diary, their awareness became sharper and deeper. Gradually they started discriminating right from wrong and good from bad. This ultimately culminated in simplicity and straightforwardness in action, speech and thought. The questionnaire underwent all appropriate statistical scrutiny to prove its authenticity, reliability and validity.

Aim

To observe the effects on the personality following one yama and one niyama over a long period of time.

Hypothesis

Observing one yama and one niyama leads to sharper awareness, greater discriminative ability and simplicity in action, speech and thought, and the change will occur in this sequence.

Research design

Progressive, controlled, pre-post design. Paired group t test was used to check the validity of the hypothesis between pre and post periods within the group and F statistics to compare the difference between the groups at any given period. SPSS 17 software was used for the statistical calculations and documentation.

Parameter

Changes in awareness, discrimination and simplicity: Pre & Post.

Research tool

Psychological Disposition Questionnaire

Method

The subjects of the experimental group were residential students of BYB attending different courses in the academic year 2003–04. The courses were of four-month, one-year or two-year duration. The control group was formed both by the members of Yuva Yoga Mitra Mandal (YYMM) of Munger who were involved in ashram activities, and the yoga practitioners of the Yoga Research Centre at BHEL, Bhopal, India. The subjects of the two groups were of both genders and within the age range 18 to 55 years, the majority being young adults.

The control group practised yoga but did not observe any yama or niyama and did not keep a spiritual diary. The experimental group was asked to practise one yama and one niyama of their choice and observe them to the best of their ability in their action, speech and thought. They were guided to maintain daily entries in a spiritual diary in a prescribed format. This became their sadhana for four or eight calendar months. Before these practices were introduced, the Psychological Disposition Questionnaire was given to both groups. The confidentiality of information was ensured by codifying their identity. Throughout the period of the study the experimental group was monitored by regular interactions, guidance and encouragement. At the end of the study period (four or eight months), the questionnaire was re-administered to the experimental group. In the control group it was re-administered after four months. After the post-data collection students were allowed to compare their initial answers to the questionnaire with the current one.

Results

The experimental group consisted of 43 Post Graduate students and 16 Diploma students (total 59) who practised for eight months, 17 Diploma students and 178 Yogic Studies students (total 195) who practised for four months. The control group consisted of 57 YYMM participants and 52 participants from BHEL Yoga Research Centre (total 109). The data collected is tabulated in Table 1.

In the experimental group post values showed statistically significant increase over the pre values, component 1 'awareness' showing the greatest change. The control group showed no change in any of the components. As expected the t values were highest in component 1 followed by components 2 and 3, 'discrimination' and 'simplicity'. This establishes the hypothesis within the group. Study of minimum, maximum and percentile values and accompanying graph gives a more detailed idea about the pattern of change.

The study of ANOVA statistics compares the two groups. Both groups show significant difference in pre as well as post values. This means that they are already different to begin with. The F statistic of post values is much greater than the pre values showing that the two groups have differed from each other much more after the intervention. This establishes the hypothesis between the two groups.

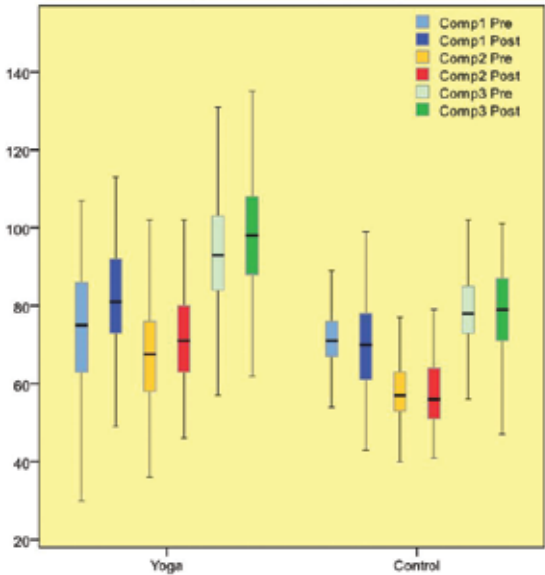
Table 1: Effect of observing yama and niyama on psychological disposition

Y: n=254 C: n=109	Mean	Std dev	t test	Significance	Min.	25 percentile	50 percentile	75 percentile	Max.	
Component 1: Awareness										
Yoga	Pre	74.42	15.44	10.03	0.000	30.00	63.00	75.00	86.25	107.00
	Post	82.25	13.56			49.00	73.00	81.00	92.00	113.00
Control	Pre	70.57	9.62	0.57	0.568	40.00	66.50	71.00	76.00	91.00
	Post	69.97	11.47			43.00	61.00	70.00	78.50	90.00
Component 2: Discrimination										
Yoga	Pre	67.04	12.40	7.03	0.000	36.00	58.00	67.00	76.00	102.00
	Post	71.32	12.06			36.00	63.00	71.00	80.00	102.00
Control	Pre	57.17	7.50	0.03	0.975	40.00	52.50	57.00	63.00	77.00
	Post	57.19	8.22			41.00	51.00	56.00	64.00	79.00

Table 1: Effect of observing yama and niyama on psychological disposition

Y: n=254 C: n=109	Mean	Std dev	t test	Significance	Min.	25 percentile	50 percentile	75 percentile	Max.
Component 3: Simplicity									
Yoga	<i>Pre</i>	92.98	16.06	6.86	0.000	46.00	84.00	93.00	103.25
	<i>Post</i>	98.03	14.93			48.00	88.00	98.00	108.00
<i>Control</i>	<i>Pre</i>	78.79	10.12	0.03	0.975	47.00	72.50	78.00	85.00
	<i>Post</i>	78.83	11.52			47.00	70.50	79.00	87.50
Total of 3 Components: Awareness + Discrimination + Simplicity									
Yoga	<i>Pre</i>	234.95	38.90	10.03	0.000	129.00	207.75	233.50	258.50
	<i>Post</i>	251.60	35.70			149.00	227.00	249.50	278.25
<i>Control</i>	<i>Pre</i>	206.52	21.16	0.25	0.807	140.00	194.00	204.00	218.00
	<i>Post</i>	205.99	24.99			150.00	183.00	209.00	225.00

Effect of Yama Niyama on Psychological Disposition



Effect of Yama Niyama on Psychological Disposition

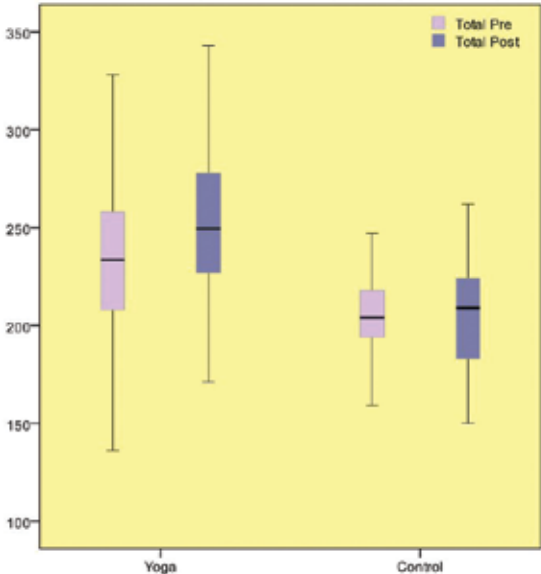


Table 2: Effect of observing yama and niyama on psychological disposition
(ANOVA Statistics)

	Component 1		Component 2		Component 3		Total	
	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>
<i>F</i>	5.829	68.323	59.773	124.678	72.775	143.546	49.185	146.895
<i>Significance</i>	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Conclusion

The hypothesis ‘Observing one yama and one niyama leads to sharper awareness, greater discriminative ability and simplicity in action, speech and thought, and the change will occur in this sequence’ is established.

Yoga and Education

TRAINING IN THE ART OF LIVING

Education is not the amassing of information, and its purpose is not mere career-hunting. It is a means of developing a fully integrated personality and enabling one to grow into the likeness of the ideal that one has set before oneself.

The purpose of true education should be to enlighten humanity, to destroy the lower nature, to better the social order and to promote human wellbeing by training the student both for external achievement and for internal attainment. The consummation and test of true education is found in the all-round development of the faculties of knowledge, love and service. There should be a harmonious development of the head, heart and hands.

Education is training in the art of living. It is not a filling-in of something from outside, but a process of drawing out all the positive potentialities, all the highest and best qualities inherent in the student. Education is the cultivation and development of these worthy qualities and talents in an intelligent and rational way, so as to build a balanced personality. The right sense of values on which one should build one's life should be revealed through education.

Education must aim at developing a spiritual attitude towards life. Spirituality does not hinder material progress. In fact it buttresses material interests. The real advancement and wellbeing of every society and nation depends upon the

right kind of educational basis. Only if an educational system rests on a spiritual foundation will science and technology best serve the interests of mankind. Science alone cannot ensure perfect peace and harmony. Humanities alone cannot cure the ills of poverty or safeguard the freedom of the country. There should be a synthesis of both.

—*Swami Sivananda Saraswati*

LEARNING FOR LIFE

Education implies that the whole being should be educated. It should not merely be pumping students full of book knowledge which just floats on the surface of their intellects as oil floats on the surface of water. People have to be aware of their thought patterns, their opinions, their ideas and their emotions. This kind of education will not come by force because that would only be borrowed knowledge, not experience. This real education has to be brought about from within, and one of the ways to accomplish this unfoldment is through yoga.

Modern education is necessary but it does not fulfil the requirements of human life. It makes you ready for serving a nation or community and earning your own livelihood, but it is not able to give you the knowledge of yourself. Therefore we should have some education institutions where our children can get yogic as well as secular education.

Children are pliable, innocent and devoted. They believe in higher realities, but they need proper training. It is better to give them discipline in the light of a spiritual and yogic education from the very beginning.

Young people must have contact with yoga. They will attain peace through yoga and spread it throughout the world. For the children of today and the civilization of tomorrow, yoga is an epoch-making philosophy.

—*Swami Satyananda Saraswati*

YOGA – A HABIT IN LIFE

Yoga for grown-ups is only a practice for body work, mind work, to release stress, to feel high and peaceful, and to disconnect from those problem areas of life that create strife within. Beyond this grown-ups fail to transform, convert or change their pre-conditioned needs, expectations, beliefs, ideas and systems.

With children, however, a balanced and positive transformation takes place in their lives, and they practise yoga in a natural, simple and spontaneous way without thinking. The practices seem to work deeper in the natures, bodies and minds of children.

Education is a system through which children learn proper expression in life. It can even be called a science of behaviour, a science of performing creatively and constructively in life, a process of learning how to live. This is the yogic concept of education.

Students often ask how to develop concentration, how to face exams without getting nervous, and how to memorize. One of the faculties of mind is memory, another is intellect and another is understanding. Intellect, memory and understanding are the three faculties that students have to manage.

Therefore, students should not think of yoga as a set of physical exercises that they do for health or for eradicating disease or illness. They should think of yoga as a way to improve and develop the strength and quality of the brain and mind. Then they will have a successful life all the way from their studies to their future life. This is the message of yoga for all – practise yoga with such determination and dedication that it becomes a habit in your life.

—*Swami Niranjanananda Saraswati*

Yoga and Adolescent Students, Chennai, 2009–2010

Yoga Research Foundation in collaboration with NKTM Jeyagopal (Sannyasi Shiva Rishi), Founder of Satyananda Yoga Centre, Chennai, and Satyananda Yoga Education Charitable Trust, Chennai.

Summary

The efficacy of the Satyananda Yoga tradition in improving education-related psychological dimensions was studied on 673 adolescent students of both genders in a progressive controlled pre-post study design. The control group had 529 subjects of both genders. Memory and rational intelligence, the two most important factors in the current education system, showed highly significant improvements. Pre-examination anxiety and self-confidence did not show any change.

Introduction

The physical benefits of yoga on growing adolescents such as flexibility, strength, endurance of the muscular-skeletal system and a balanced hormonal system are well documented. In addition, yoga reduces wavering thought patterns and encourages one-pointed awareness. This improves the grasping and reproducing powers of memory. It also improves rational and clear thinking. Good memory and intelligence help one to be in control of one's situation and boosts one's self-confidence. The result of all these benefits in a student's life is a higher success rate in every action undertaken including academic performance.

Yoga Research Foundation (YRF) in collaboration with Satyananda Yoga Education Charitable Trust, Chennai, conducted extensive research in six schools in Chennai in the academic year 2009–2010 to study some of the benefits of yoga on mind.

Hypotheses

Regular yoga practice in adolescent students will:

- Reduce examination-induced anxiety
- Improve memory
- Improve self-confidence
- Improve the rational component of intelligence
- Improve academic performance.

Research design

Progressive controlled pre-post design; F statistics calculated on SPSS 17 software was used to prove the hypotheses.

Period

April 2009 to March 2010

Parameters

Except for the first parameter all data were collected in the beginning and at the end of the academic year for class X or class XII.

- Examination-induced anxiety was measured using STAI questionnaire three days prior to class IX (or class XI) annual examination (pre reading) and class X (or class XII) preliminary examination (post reading) (one examination before the board examination);
- Memory was measured using PGI Memory Scale;
- Agnihotri's Self-Confidence Inventory ASCI was used to measure self-confidence;
- Logical/rational/linear intelligence was measured using Advanced Progressive Matrices APM;
- Academic performance was measured by marks obtained from class IX (or class XI) annual examination and class X (or class XII) preliminary examination.

Selection criteria

Six schools agreed to participate in the study for their students of classes X and XII. Three schools agreed to be control, two schools agreed to be yoga participants and a

sixth school gave its students the option of either being in the control group or the yoga group.

Exclusion criteria

Subjects who failed to complete pre and post testing of two or more psychological tests out of a total four.

Subjects

- 407 girls and 342 boys, total 749 students enrolled for the experimental or yoga group.
- 371 girls and 334 boys, total 705 enrolled for the control group.
- Finally 673 participants, 385 girls and 288 boys in the yoga group and 529 participants, 285 girls and 244 boys in the control group qualified to be included in the study.

Table 1: Characteristics of the sample

	Experimental group	Control group
<i>Strength (n)</i>	673	529
<i>Mean age</i>	15 y : 2 m	15 y :1 m
<i>Girls : Boys</i>	385 : 288	285 : 244
<i>Class X : Class XII</i>	408 : 259	401 : 128

Experiment

Pre testing of all the parameters was planned and executed at the beginning of the academic year except the STAI test for anxiety which was done at the end of the previous academic year. The tests, which were designed for one-to-one application between researcher and subject, were adapted to be administered on a big group of subjects without changing the content of the tests. The yoga group received forty minutes of class twice weekly for the whole academic year. It was incorporated in the daily schedule and

the attendance was compulsory. The yoga syllabus included asana, pranayama, yoga nidra and chanting of the Gayatri mantra. There were no interferences in their lifestyle, academic program or diet. The control group continued with its routine without any interference. At the end of the academic year, post testing of all the parameters was planned and executed. The post reading of academic performance was not possible as the marking system of examinations changed from marks to grades. So that parameter had to be dropped.

Results

In most of the tests the changes in raw scores were small but the sample size was very big and hence even the small change was significant.

Refer to Table 2. The first parameter of Pre-examination Anxiety showed only a marginal change. Both the groups continued to stay in 'moderate anxiety' grade at the end of the study period. Contrary to expectation the control group showed a little more reduction in anxiety than the experimental group (0.077). See Graph 1.

The parameter of Memory showed greater improvement in the yoga group (0.046). The control group also showed improvement which could be the 'practice effect'. See Graph 2.

The parameter of Self-Confidence showed marginal improvement in both groups, improvement in the control group being a shade better (0.750) than in the yoga group. See Graph 3.

The last parameter of Rational Intelligence showed significant improvement in the yoga group (0.004 to 0.000). The control group took less time to complete the test, but their performance deteriorated. Graph 4 shows their performance in the form of raw score. Graph 5 shows time taken in minutes to complete the test. Graph 6 shows their performance in percentile score that corrects the effect of age factor.

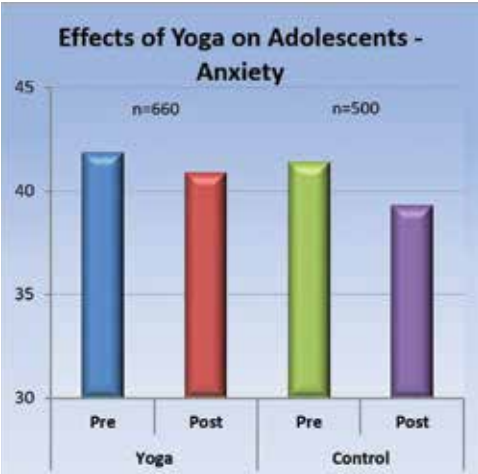
Table 2: Effects of yoga in adolescents

Y: n=673 C: n=529	Yoga		Control	
	<i>Pre</i>	<i>Post</i>	<i>Pre</i>	<i>Post</i>
<i>Anxiety</i>	41.86	40.90	41.39	39.30
<i>Memory</i>	76.39	80.18	75.84	78.45
<i>Self-confidence</i>	23.26	22.42	22.29	21.30
<i>Intelligence-Score</i>	20.02	21.77	18.49	18.84
<i>Intelligence-Time</i>	28.30	23.96	24.96	19.12
<i>Intelligence-Percentile</i>	78.26	78.23	74.06	67.43

Table 2a: Statistical significance of effects of yoga in adolescents

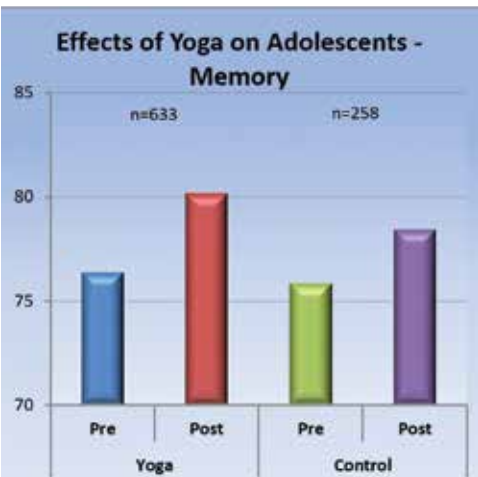
Y: n=673 C: n=529	F	Significance	Partial eta squared	Observed power
<i>Anxiety</i>	3.143	0.077	0.003	0.425
<i>Memory</i>	3.985	0.046	0.004	0.514
<i>Self-confidence</i>	0.101	0.750	0.000	0.062
<i>Intelligence-Score</i>	21.826	0.000	0.019	0.997
<i>Intelligence-Time</i>	8.153	0.004	0.007	0.814
<i>Intelligence-Percentile</i>	24.710	0.000	0.022	0.999

Graph 1



Key: < 25 Normal or no anxiety
25–34 Low anxiety
35–44 Moderate anxiety
45 or > High anxiety

Graph 2



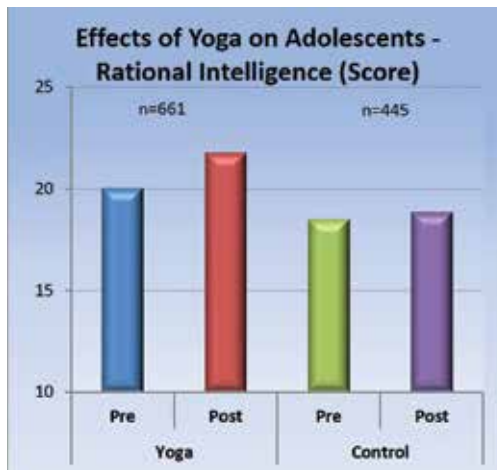
Key: The higher the value, the better the memory
Maximum score is 98

Graph 3



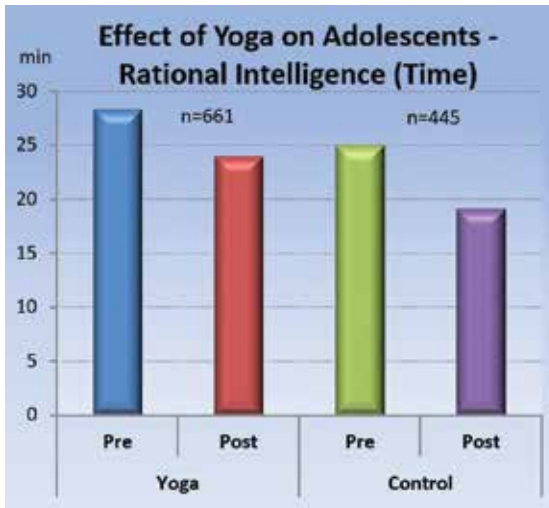
Key: < 7 Very high self-confidence
8-19 High self-confidence
20-32 Average self-confidence
33-44 Low self-confidence
45 < Very low self-confidence

Graph 4



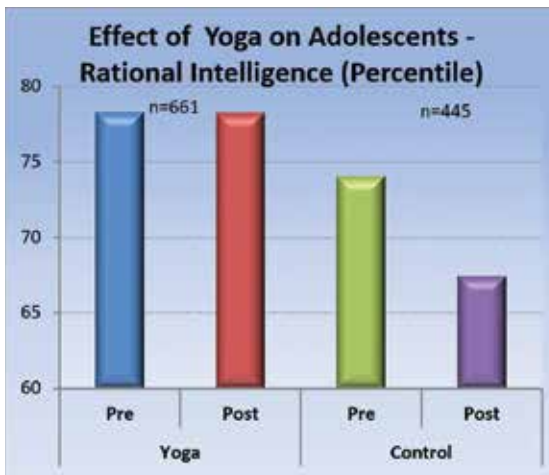
Key: The higher the value, the better the memory
Maximum score is 36

Graph 5



Key: The lower the value, the quicker the reasoning

Graph 6

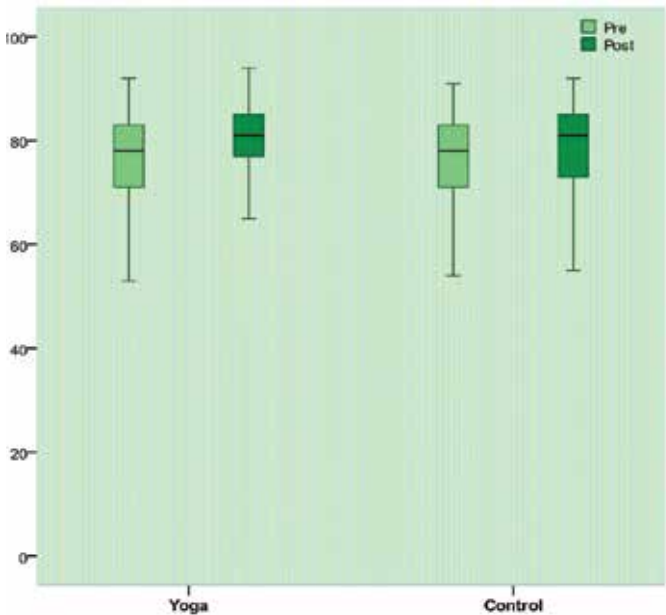


Key: The higher the value, the better the intelligence.
Percentile data rules out the effect of age; up to a certain age the rational intelligence increases with age.

The study of percentile distribution of the data gives an idea whether the change was dispersed uniformly over the whole group or more concentrated in one of the sections of a group. The following box-plot graphs express it clearly.

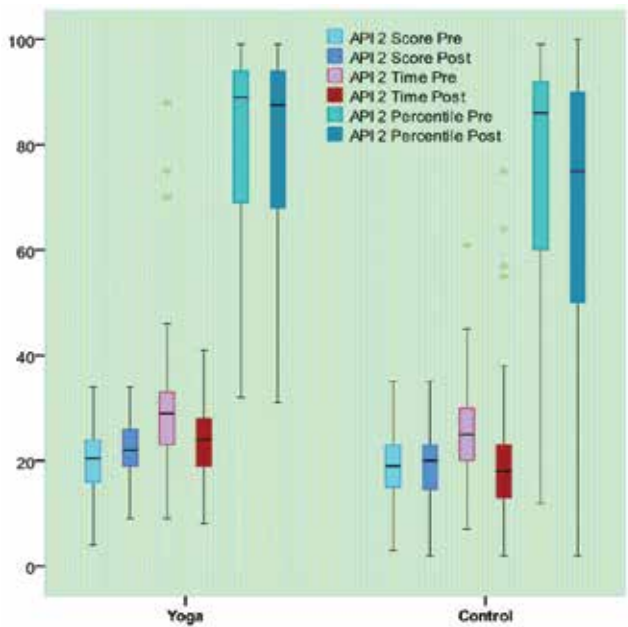
The parameter of Memory showed major improvement in lower whisker and lower half of the box indicating that the lower half of the group had a big improvement in memory. The upper half of the box and the upper whisker showed but a small improvement indicating that the improvement in the upper half of the group was comparatively small. It is important to know that no section of the group deteriorated. In the control group there was a small improvement in the middle section of the group.

Effect of Yoga on Memory in Adolescents



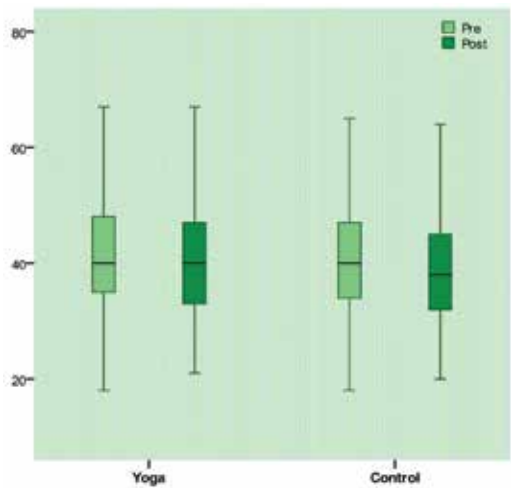
The parameter of intelligence was measured in two dimensions, raw score and time taken in minutes to complete the test. The raw score was then converted into percentile score keeping age factor in the calculation. The graph shows that the yoga group showed overall improvement in raw score except the highest ranking section but after correction for age factor there was no change in percentile score. The control group as a whole showed no change in raw score but a great deterioration in percentile score except the highest ranking section which showed no change. Both groups took less time for the test than before, but the improvement in the time dimension was greater in the control group than in the yoga group.

Effect of Yoga on Intelligence in Adolescents

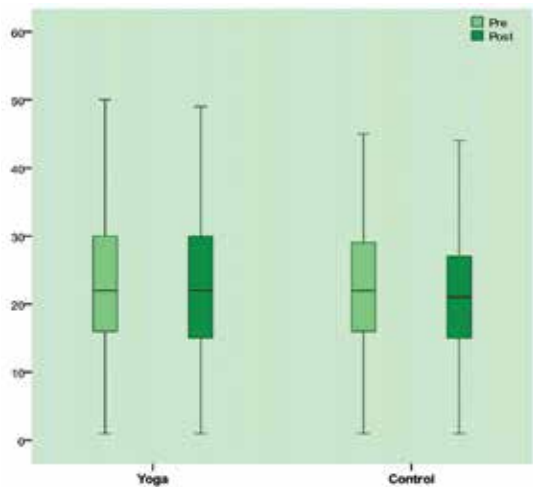


The results of STAI test for Anxiety and ASCI test for Self-Confidence showed minimal or no change in the yoga group. In the control group anxiety reduced and self-confidence improved in the whole of the middle section.

Effect of Yoga on Anxiety in Adolescents



Effect of Yoga on Self-Confidence in Adolescents



Conclusion

Of the five hypotheses two could be proved, two were rejected and one could not be studied.

- Examination-induced anxiety did not reduce – hypothesis rejected
- Regular practice of yoga significantly improved memory – hypothesis proven
- Level of self-confidence did not improve – hypothesis rejected
- Regular practice of yoga significantly improved linear intelligence – hypothesis proven
- Academic performance – the parameter was dropped. However it can be noted that the academic performance of the board examinations for class X as well as class XII was exceptionally better than previous years in all the schools that had opted for yoga intervention.

Inconclusive Research

I: Promotion of Health

Diabetes Study, 2000

Summary

22 subjects with diabetes type I & type II practised yoga for two weeks in an ashram environment. Their fasting blood sugar did not show much improvement, but 2 hours post-lunch sugar level showed significant improvement (0.041). Four out of twenty-two subjects were insulin dependent and this changed the result to a great extent.

Research experiment

Inspired by the results of the diabetes study of 1998 (see *Yoga Research Foundation: Volume Two – Promotion of Health 1998–2007*), Yoga Research Foundation decided to run a pilot study to observe the effect of yoga on blood sugar in type I as well as type II diabetics. In the year 2000, 22 participants of the Diabetes Health Management Course of 18 days duration formed the sample. After obtaining individual consent to participate in the research, a preliminary biodata was collected from the participants. Their fasting and post-prandial (2 hours after lunch) blood sugar level was tested in the pathology laboratory. The yoga training consisted of morning 90 minutes of asana class, and three other classes of 1 hour each for pranayama and mantra, yoga nidra and meditation, revision and satsang. Once a week, morning asana class was replaced by the hatha yoga cleansing practices of shatkarmas. In addition the participants had 1 hour of karma yoga (cleaning) in the morning, 1 hour of bhakti yoga in the evening and 1 hour of seva in any of the ashram departments during the day as part of ashram life. They had classes six days a week, or fifteen working days during the course. The blood sugar fasting and post-lunch tests were repeated after one week and at the end.

Results

The group was more heterogeneous than in the 1998 study. There were 20 men and only 2 women of the total 22 participants. 3 of them were not taking any medication, 15 were on oral diabetic medication and 4 were on insulin. 5 were hypertensive, 3 had ischemic heart disease, 1 had asthma, 1 had had a cerebro-vascular accident and 1 had developed nephro-neuro-retinopathy due to diabetes.

The group showed almost no change in fasting blood sugar level but significant lowering of post-lunch sugar level. See Tables 1 and 2 and accompanying graphs. The drug dosage did not change significantly. See Tables 1 and 3.

Table 1: Effect of yoga on blood sugar in diabetics: statistical values

Blood sugar	F	Significance	Partial eta squared	Observed power
<i>Fasting</i>	0.192	0.827	0.019	0.076
<i>Post-lunch</i>	3.776	0.041	0.274	0.620
<i>Drugs</i>	0.983	0.392	0.089	0.197

Table 2: Effect of yoga on blood sugar in diabetics: mean values

Blood sugar	Pre	Mid	Post
<i>Fasting</i>	139.64	138.27	136.32
<i>Post-lunch</i>	181.64	195.91	165.41

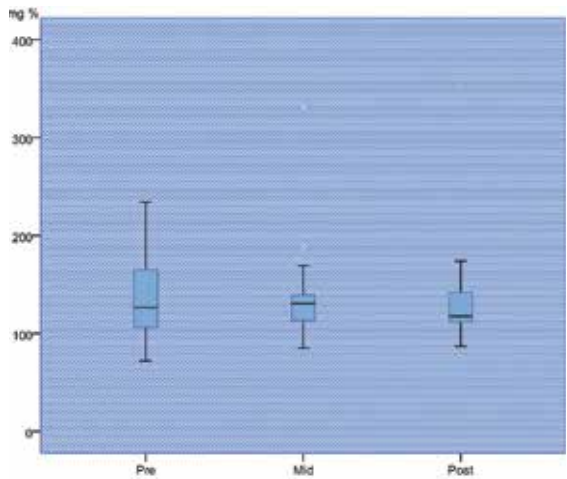
Table 3: Effect of yoga on drug dosage in diabetics

	Pre	Mid	Post
<i>Tablets</i>	29	28	27
<i>Insulin units</i>	84	70	71

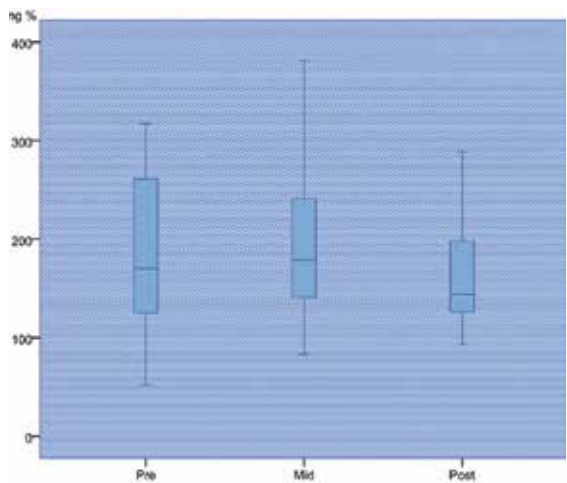
Conclusion

Yoga can significantly lower post-lunch blood sugar in diabetics. Its effect on fasting sugar was not significant, probably due to the group being a mixed group (type I & II). The drug dosage remained unaltered.

Effect of Yoga on Fasting Blood Sugar in Diabetics



Effect of Yoga on Post-Lunch Blood Sugar in Diabetics



Diabetes Mellitus, 2006–2007

SUMMARY REPORT OF RESEARCH STUDY

Method

- 21 subjects in the experimental group practised Satyananda Yoga for six months. They continued with their medication.
- 25 subjects in the control group continued with their medication.
- Both groups were followed every month for six months for the following parameters.
- Parameters:
 1. Symptoms of fatigue, polyphagia, sensory disturbance, vision disturbance, weight loss and quality of sleep
 2. Fasting and 2 hours post-lunch blood sugar and glycosylated haemoglobin HbA1c
 3. Medication for diabetes (not done)
 4. Clinical observations of systolic and diastolic blood pressure, Body Mass Index (BMI) and ratio of waist to hip circumference
 5. Laboratory investigations – blood urea nitrogen, serum creatinine and lipid profile.

Results

1. *Symptoms*: Two symptoms, polyphagia and vision disturbances, are significantly reduced in the yoga group.
2. *Blood sugar tests*: None of the three tests showed significant improvement in the yoga group.
3. *Clinical observations*: None of the four parameters showed significant improvement in the yoga group.
4. *Laboratory tests*: No significant change in kidney functions or lipid profile was found in the yoga group.

Table 1: Diabetes – symptoms: statistical values

Y: n=21 C: n=25	F	df	Signifi- cance	Partial eta squared	Observed power
Fatigue	0.457	6.000	0.836	0.066	0.167
Polyphagia	3.169	6.000	0.013	0.328	0.875
Sensory disturbance	0.632	6.000	0.704	0.089	0.221
Visual disturbance	2.535	6.000	0.036	0.281	0.778
Weight loss	0.363	6.000	0.898	0.053	0.139
Quality of sleep	0.540	6.000	0.775	0.077	0.192

Table 2: Diabetes – blood sugar tests: mean values

Y: n=21 C: n=25		Pre	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
<i>Bl sug – fasting (mg%)</i>	<i>Yoga</i>	153.19	131.91	122.86	130.62	131.95	123.00	118.86
	<i>Control</i>	160.72	140.80	143.80	131.32	136.28	132.96	134.08
<i>Bl sug – post-lunch (mg%)</i>	<i>Yoga</i>	200.67	179.29	172.52	202.10	189.10	184.95	172.19
	<i>Control</i>	233.72	199.68	202.60	203.08	200.96	198.04	205.56
<i>HbA1c (%)</i>	<i>Yoga</i>	8.69	-	-	8.14	-	-	7.78
	<i>Control</i>	9.41	-	-	8.53	-	-	8.37

Table 3: Diabetes – blood sugar tests: statistical values

Y: n=21 C: n=25	F	df	Signifi- cance	Partial eta squared	Observed power
<i>Bl sug – fasting</i>	1.013	6.000	0.431	0.135	0.350
<i>Bl sug – post-lunch</i>	2.258	6.000	0.058	0.258	0.720
<i>HbA1c</i>	0.451	2.000	0.640	0.021	0.119

Table 4: Diabetes – clinical parameters: statistical values

	F	df	Significance	Partial eta squared	Observed power
<i>SBP</i>	0.526	6.000	0.785	0.075	0.188
<i>DBP</i>	0.331	6.000	0.916	0.049	0.130
<i>BMI</i>	1.380	6.000	0.247	0.175	0.474
<i>W/H</i>	0.210	6.000	0.971	0.031	0.098

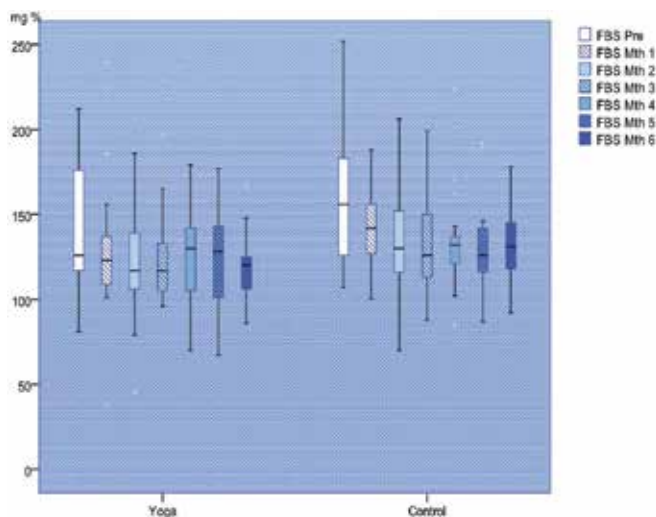
Table 5: Diabetes – kidney functions & lipid profile: statistical values

	F	df	Significance	Partial eta squared	Observed power
<i>BUN</i>	0.321	2.000	0.727	0.015	0.098
<i>S. Creatinine</i>	0.146	2.000	0.864	0.007	0.071
<i>S. Cholesterol</i>	1.243	2.000	0.299	0.057	0.25
<i>Triglyceride</i>	0.081	2.000	0.922	0.004	0.062
<i>HDL</i>	0.425	2.000	0.657	0.020	0.114
<i>LDL</i>	0.200	2.000	0.819	0.010	0.460

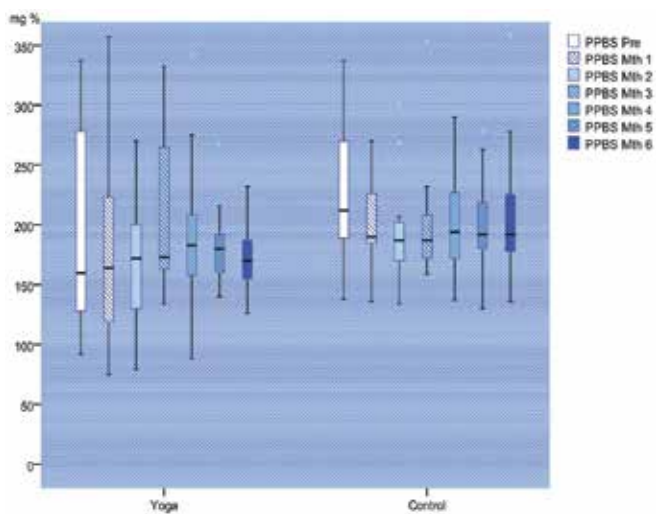
Conclusion

1. The research study could not support any of the following hypotheses.
2. In type II diabetic subjects' regular practice of Satyananda Yoga:
 - reduces the symptoms – not proved
 - reduces raised blood sugar levels and improves HbA1c – not proved
 - reduces need for drug consumption – not studied
 - reduces raised systolic and diastolic BP – not proved
 - improves the risk factors like BMI & waist/hip circumference – not proved
 - improves lipid profile – not proved

Effect of Yoga on Fasting Blood Sugar in Diabetics



Effect of Yoga on Post-Lunch Blood Sugar in Diabetics



Diabetes Mellitus, 2006–2007

Yoga Research Foundation, Munger, and Dr. Niagam Dept. of Medicine, Kasturba Hospital, BHEL, Bhopal, India

Summary

The efficacy of Satyananda Yoga practices as a complementary treatment in the management of diabetes type II for members of the industrial community of BHEL was studied over a period of six months in a controlled trial with 21 subjects in the yoga group and 25 subjects in the control group. The parameters used were symptoms, objective clinical observations and laboratory tests. We found significant relief in two symptoms: polyphagia (F 3.169; significance 0.013) and vision disturbances (F 2.535; significance 0.036). The fasting glucose level in the blood showed a downward trend in both the groups, more so in the yoga group. The post-lunch blood sugar and HbA1c showed downward trends of similar magnitude in both groups. None of these parameters showed a significant difference between the two groups.

Introduction

With modern competitive, fast yet sedentary living and fat, protein-rich diet, diseases of the metabolic syndrome like hypertension, diabetes and ischemic heart diseases are threatening humankind especially in industrialized areas. Indians are genetically more vulnerable to develop diabetes. The diabetics need lifelong medical treatment; they have high morbidity affecting every organ of the body and eventually have high mortality. Yoga has been found an effective complementary method of treatment by many researchers in the past. In our own experience also yoga was found very useful but most of the studies done in the past were of short duration, two to four weeks only. In this study we tried to observe the efficacy of Satyananda Yoga over a period of six months.

Hypotheses

In type II diabetic subjects' regular practice of Satyananda Yoga:

1. Reduces the symptoms
2. Reduces raised blood sugar levels and improves HbA1c
3. Reduces the need for drug consumption
4. Reduces raised systolic and diastolic BP and the pulse-rate
5. Improves the risk factors like BMI & waist/hip circumference
6. Improves lipid profile.

Research design

1. Controlled, repeated measures trial, allocation of group by subject's choice;
2. Statistical analysis was done using SPSS 17 software:
 - F statistics using General Linear Model, repeated measures and two-tailed, paired sample students t test – to establish significance of change in variables within the group, to reject null hypothesis
 - Descriptive study (mean and percentile) – to quantify the change in parameters
 - Distribution of severity of symptoms in terms of percentage of subjects.

METHOD

A. Selection

Inclusion criteria:

- BHEL employee/retired employee and their dependent family members who are eligible for medical facility at BHEL-run Kasturba Hospital, Bhopal, India, with established diagnosis of diabetes type II
- Adult male and female below the age of 70 years
- Willing to participate in the study

Exclusion criteria:

- Attendance in yoga class <35%
- Monthly follow up <3 times throughout the study

B. Duration, place of study and number of subjects

- The study was conducted at Kasturba Hospital, BHEL, Bhopal, India, and the yoga classes were conducted at the Yoga Research Center, BHEL, Bhopal, under supervision of Bihar School of Yoga and Yoga Research Foundation, Munger, India.
- 25 subjects were recruited each in the experimental group (medicine plus yoga) and the control group (only medicine).
- The selected subjects in the yoga group attended daily yoga classes, six days in a week, for six months continuously.
- The selected subjects were observed for six months continuously during the period May 2006 to September 2007.

C. Parameters

- *Symptoms*: pre & once a month for 6 months

Fatigue	(0–3 grades)	by enquiring
Polyphagia	(0–3 grades)	by enquiring
Sensory disturbance	(0–3 grades)	by enquiring
Vision disturbance	(0–3 grades)	by enquiring
Weight loss	(0–3 grades)	by enquiring
Quality of sleep	(0–3 grades)	by enquiring
- *Objective Clinical Observations*: pre & once a month for 6 months

Systolic Blood Pressure in mmHg, digital sphygmomanometer		
Diastolic Blood Pressure in mmHg, digital sphygmomanometer		
BMI (body weight in kg/square of height in metre), weighing scale & measure tape		
Waist/hip circumference each measured in cm, measuring tape		
- *Laboratory tests*:

F & PP blood sugar	mg %	pre & once a month for 6 months
HbA1c	%	pre, mid & post
BUN & Serum creatinine	mg %	pre, mid & post
Lipid profile	mg %	pre, mid & post

- *Use of medication:* pre & once a month for 6 months
All hypoglycemic drugs: daily dose
Support drug for a sequel of DM (if any): daily dose
Drug for associated major condition (if any): daily dose

The record of medication could not be maintained in a reliable way and hence was omitted from the experimental design.

D. Procedure of study

The patients with established diagnosis of diabetes type II and of age not more than 70 years, attending the medicine OPD at Kasturba Hospital were informed about the research study. Those who were willing to participate were screened for major medical disorders. On fulfilment of selection criteria, informed consent was taken from the participants individually. If it was convenient for them to attend yoga classes daily over six months they were recruited in the yoga or the experimental group; if not, they were allocated to the control group.

On the recruitment of a subject, basic biodata and clinical history were collected. He was clinically evaluated and basic laboratory tests were carried out. The 'pre' levels of all the parameters were recorded for both groups. The study was concluded after six months. Both groups continued medical treatment as advised by their doctor but the experimental group practised yoga under supervision for one hour six days a week for six months. 25 subjects were recruited in each group but four in the yoga group disqualified due to inadequate attendance in the yoga class, leaving 21 in the yoga and 25 in the control group.

The experimental group practised selected asanas, pranayamas, yoga nidra and other pratyahara and dharana practices daily. In addition they practised the hatha yoga cleansing practices jala neti, kunjal kriya and laghoo shankhaprakshalana at regular interval. They also practised mantra and kirtan (devotional singing) periodically. They were addressed on various yogic concepts like yoga lifestyle, mantra, bhakti, seva (See Appendix for detailed yoga

program). An attendance register was maintained to observe their regularity. Both groups were asked to report for follow-up every month.

On follow-up visits six symptoms were recorded by asking direct questions to the subjects. The symptoms were recorded in 0 to 3 grades where 0 meant no symptoms, grade 1 mild, grade 2 moderate and grade 3 severe symptoms. Five clinical parameters were also recorded.

All laboratory tests were done in the beginning (pre), after three months (mid) and after six months (post), except fasting and post prandial blood sugar levels which were done in the beginning and then every month. Lipid profile included serum triglyceride, serum cholesterol, HDL and LDL.

It was planned to note down the medicines used in the beginning and subsequently every month during the follow-up visits. They were categorized in three groups:

1. hypoglycemic agents
2. support drugs for a sequel of DM like IHD, neuropathy or repeated infections
3. drugs for associated major conditions like hypertension, hypothyroid or arthritis.

RESULTS AND DISCUSSION

A. Characteristics of the sample

There were 21 subjects in the yoga group and 25 in the control group. Their characteristics are presented in Table 1. In the yoga group 19 were already practising some yoga, 9 were participating in sports, exercise or walking. All subjects were doing some form of physical exercise. In the control group no subject was doing any yoga, 21 were participating in sports, exercise or walking, and 4 were not doing anything. In the yoga group the work-related stress was present in 6 subjects and 1 had stress due to family life, while in the control group 7 subjects had work-related stress and none had stress in the family. 4 subjects in the yoga group and 8 in the control group had sleep disturbances.

Table 1: Characteristics of the sample

	Yoga	Control
<i>No. of subjects</i>	21	25
<i>Age in yrs; mean (range)</i>	62.6 (46~74)	57 (39~70)
<i>Gender</i>	f:3; m:18	f:8; m:17
<i>Diet</i>	17 veg; 4 non-veg	17 veg; 8 non-veg
<i>Duration in yrs; mean (range)</i>	7.3 (1~22)	10.19 (2~25)
<i>Family h/o DM</i>	5	2
<i>Associated conditions</i>	HBP:12; asthma:1; IHD:1; chol:2; insulin:1	HBP:18; chol:2
<i>Attendance; mean (range)</i>	66.58% (36~89 %)	not applicable

B. Symptoms

Fatigue

The occurrence and severity of six symptoms were recorded every month on follow-up visits. In both the groups the incidence of fatigue gradually and steadily reduced throughout. In the yoga group 10% subjects were without the symptom of fatigue to begin with but as time passed, more and more subjects remained without the symptom of fatigue. In the last month 55% subjects were without the symptom. The severity of symptom, when present, also diminished steadily over the period. In the control group the incidence of symptom-free subjects increased from 20% in the beginning to 65% at the end. The severity also decreased steadily. See Table 2 and accompanying graphs. The change in this symptom was not statistically significant. See Table 8.

In diabetes the pancreatic hormone insulin that regulates carbohydrate metabolism and the glucose level in the blood is either not secreted in adequate amount or more commonly, tissues become resistant to its action. As a result

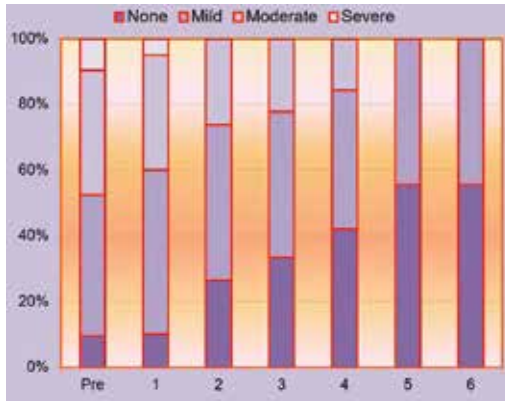
the glucose level in the blood rises and in spite of increased availability of glucose, it is not able to enter any cell and the cells are starving of the source of energy. When the muscle tissues have inadequate supply of energy, the individual feels fatigued. Yoga practices are believed to re-establish the sensitivity of tissues to the action of insulin.

Table 2: Diabetes – progressive incidence & severity of fatigue

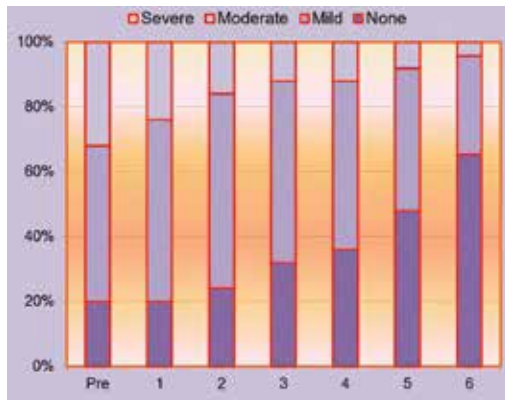
Yoga (n=21)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	21	9.52	42.86	38.10	9.52
<i>1</i>	21	9.52	47.62	33.33	4.76
<i>2</i>	19	26.32	47.37	26.32	
<i>3</i>	18	33.33	44.44	22.22	
<i>4</i>	19	42.11	42.11	15.79	
<i>5</i>	18	55.56	44.44		
<i>6</i>	18	55.56	44.44		

Control (n=25)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	25	20.00	48.00	32.00	
<i>1</i>	25	20.00	56.00	24.00	
<i>2</i>	25	24.00	60.00	16.00	
<i>3</i>	25	32.00	56.00	12.00	
<i>4</i>	25	36.00	52.00	12.00	
<i>5</i>	25	48.00	44.00	8.00	
<i>6</i>	23	65.22	30.43	4.35	

DM – Severity of Fatigue in Yoga Group



DM – Severity of Fatigue in Control Group



Polyphagia

In both groups the incidence as well as severity of symptom of polyphagia reduced steadily and gradually but more so in the yoga group. In the yoga group, the incidence reduced from 76% to 45%. In the control group the incidence of symptom of polyphagia decreased from 32% to 17%. See Table 3 and accompanying graphs. The change in this symptom is statistically significant ($F = 3.169$; significance 0.013). See Table 8.

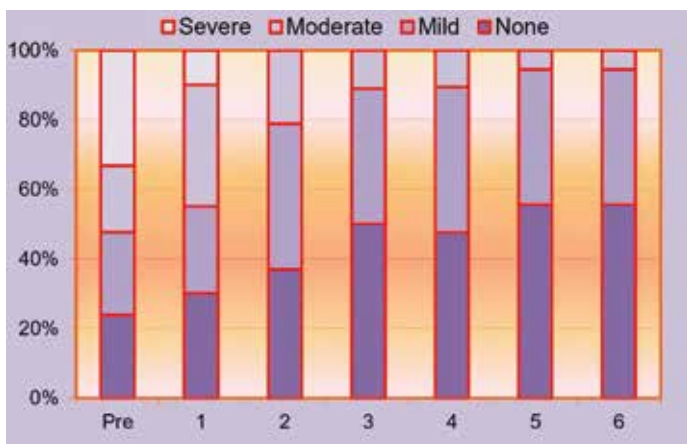
Polyphagia means increased food intake due to excessive desire to eat. It is an important symptom in diabetes. It is due to poor utilization of the available source of energy. The yogic postures and pranayama are believed to improve the utilization of the circulating glucose. When the tissues are adequately nourished then the stimulus for more intake of food does not go to the brain and the desire to eat is reduced.

Table 3: Diabetes – progressive incidence & severity of polyphagia

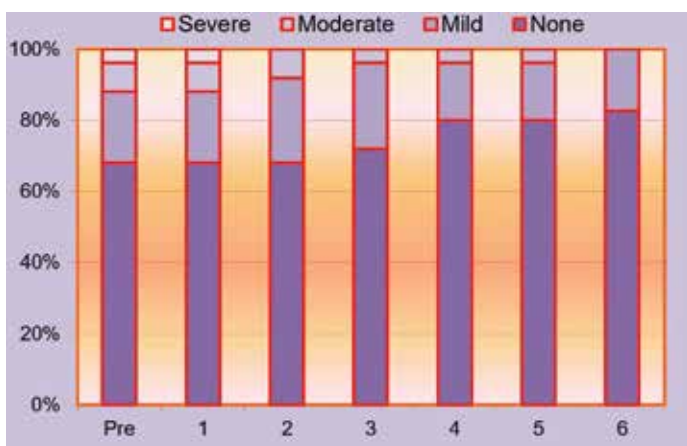
Yoga (n=21)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	21	23.81	23.81	19.05	33.33
1	20	30.00	25.00	35.00	10.00
2	19	36.84	42.11	21.05	
3	18	50.00	38.89	11.11	
4	19	47.37	42.11	10.53	
5	18	55.56	38.89	5.56	
6	18	55.56	38.89	5.56	

Control (n=25)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	25	68.00	20.00	8.00	4.00
1	25	68.00	20.00	8.00	4.00
2	25	68.00	24.00	8.00	
3	25	72.00	24.00	4.00	
4	25	80.00	16.00	4.00	
5	25	80.00	16.00	4.00	
6	23	82.61	17.39		

DM – Severity of Polyphagia in Yoga Group



DM – Severity of Polyphagia in Control Group



Sensory disturbances

The symptom of sensory disturbances, include paraesthesia like tingling, numbness, heat or burning and decreased sensation of touch, pain and temperature. This is due to peripheral neuritis. In both groups the occurrence and severity of this symptom steadily and gradually reduced

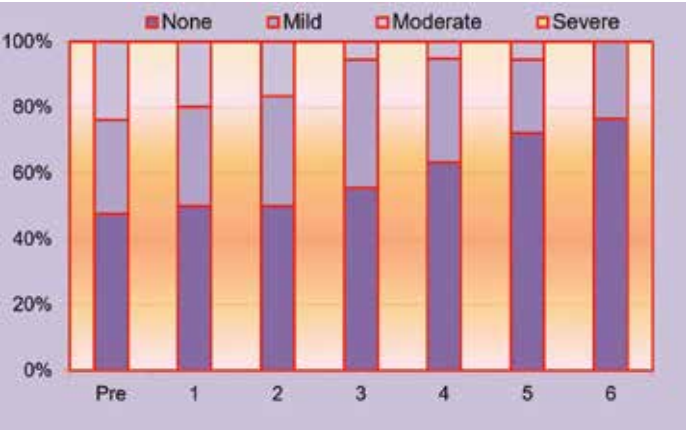
throughout in a similar pattern. In the yoga group it decreased from 52% to 24% and in the control group from 56% to 22%. See Table 4 and accompanying graphs. The difference between the groups was not statistically significant. See Table 8.

Table 4: Diabetes – progressive incidence & severity of sensory disturbance

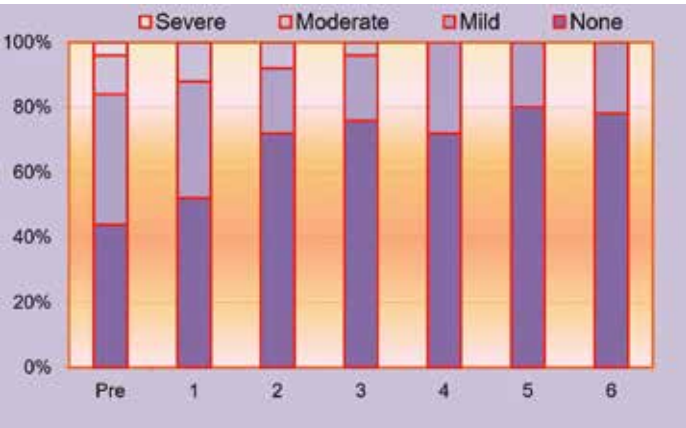
Yoga (n=21)					
% of subjects with symptom					
Mth	Subs	None	Mild	Mod	Severe
Pre	21	47.62	28.57	23.81	
1	20	50.00	30.00	20.00	
2	18	50.00	33.33	16.67	
3	18	55.56	38.89	5.56	
4	19	63.16	31.58	5.26	
5	18	72.22	22.22	5.56	
6	17	76.47	23.53		

Control (n=25)					
% of subjects with symptom					
Mth	Subs	None	Mild	Mod	Severe
Pre	25	44.00	40.00	12.00	4.00
1	25	52.00	36.00	12.00	
2	25	72.00	20.00	8.00	
3	25	76.00	20.00	4.00	
4	25	72.00	28.00		
5	25	80.00	20.00		
6	23	78.26	21.74		

DM – Severity of Sensory Disturbance in Yoga Group



DM – Severity of Sensory Disturbance in Control Group



Vision disturbances

In the yoga group the occurrence of the symptom of vision disturbances fell steadily and gradually from 57% to 22% while in the control group it reduced from 4% to 0%. See Table 5 and accompanying graphs. The change in this symptom is statistically significant (0.036). See Table 8.

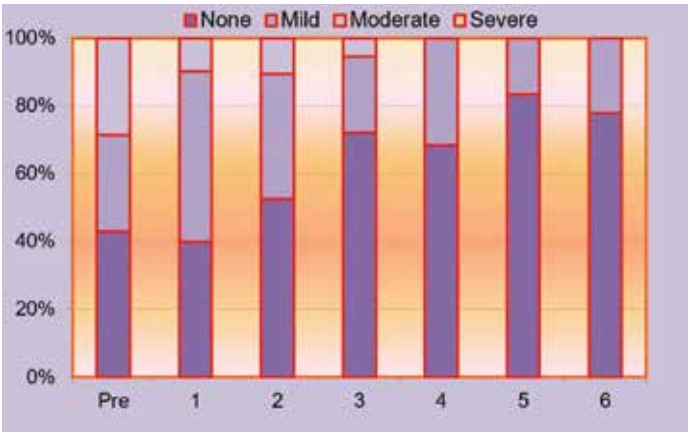
Diabetics often experience frequent change in eye-glasses or major eye problems like cataract, retinopathies and ocular haemorrhage. We have included all these conditions under the symptom of vision disturbances. Better control of blood glucose level gives relief in vision disturbances.

Table 5: Diabetes – progressive incidence & severity of vision disturbance

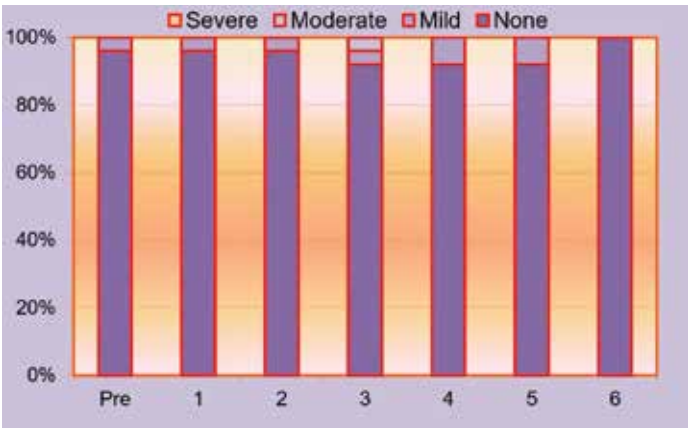
Yoga (n=21)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	21	42.86	28.57	28.57	
<i>1</i>	20	40.00	50.00	10.00	
<i>2</i>	19	52.63	36.84	10.53	
<i>3</i>	18	72.22	22.22	5.56	
<i>4</i>	19	68.42	31.58		
<i>5</i>	18	83.33	16.67		
<i>6</i>	18	77.78	22.22		

Control (n=25)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	25	96.00	4.00		
<i>1</i>	25	96.00	4.00		
<i>2</i>	25	96.00	4.00		
<i>3</i>	25	92.00	4.00	4.00	
<i>4</i>	25	92.00	8.00		
<i>5</i>	25	92.00	8.00		
<i>6</i>	23	100.00			

DM – Severity of Vision Disturbance in Yoga Group



DM – Severity of Vision Disturbance in Control Group



Loss of body weight

The symptom of loss of body weight occurs due to the inability of the tissues to use the nutrients which are lost in urine or stool. Proper control of diabetes corrects this discrepancy of metabolism and allows the body to achieve optimum body weight. The symptom of weight loss in the

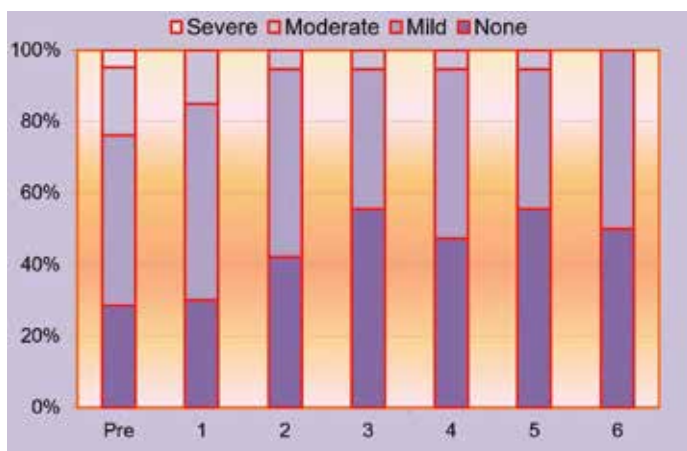
yoga group slowly reduced from 71% to 50%. Similarly in the control group too it reduced from 60% to 30%. See Table 6 and accompanying graphs. The difference between the groups was not statistically significant. See Table 8.

Table 6: Diabetes – progressive incidence & severity of weight loss

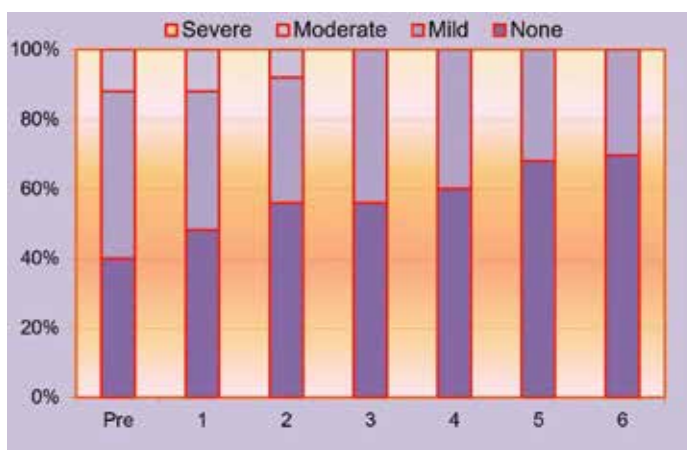
		Yoga (n=21)			
		% of subjects with symptom			
Mth	Subs	None	Mild	Mod	Severe
Pre	21	28.57	47.62	19.05	4.76
1	20	30.00	55.00	15.00	
2	19	42.11	52.63	5.26	
3	18	55.56	38.89	5.56	
4	19	47.37	47.37	5.26	
5	18	55.56	38.89	5.56	
6	18	50.00	50.00		

		Control (n=25)			
		% of subjects with symptom			
Mth	Subs	None	Mild	Mod	Severe
Pre	25	40.00	48.00	12.00	
1	25	48.00	40.00	12.00	
2	25	56.00	36.00	8.00	
3	25	56.00	44.00		
4	25	60.00	40.00		
5	25	68.00	32.00		
6	23	69.57	30.43		

DM – Severity of Weight Loss in Yoga Group



DM – Severity of Weight Loss in Control Group



Quality of sleep

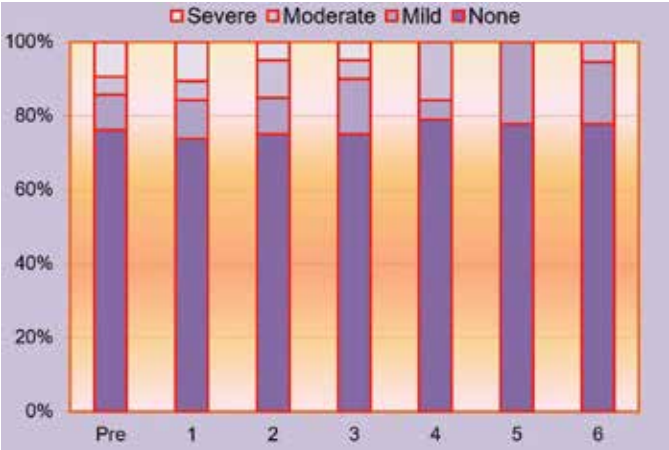
When health is disturbed at the physical or psychological level sleep usually is disturbed. Sound sleep is an indirect measure of good health. In both groups the quality of sleep did not change much. See Table 7 and accompanying graphs. The difference between the groups was not statistically significant. See Table 8.

Table 7: Diabetes – progressive incidence & severity of sleep disturbance

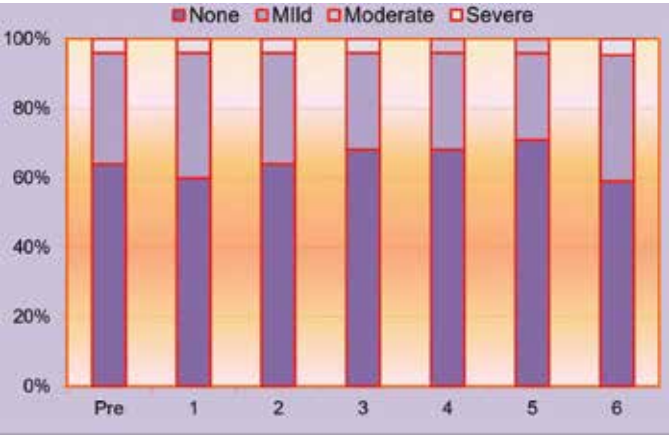
Yoga (n=21)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	25	64.00	32.00		4.00
<i>1</i>	25	60.00	36.00		4.00
<i>2</i>	25	64.00	32.00		4.00
<i>3</i>	25	68.00	28.00		4.00
<i>4</i>	25	68.00	28.00	4.00	
<i>5</i>	24	70.83	25.00	4.17	
<i>6</i>	22	59.09	36.36		4.55

Control (n=25)					
% of subjects with symptom					
<i>Mth</i>	<i>Subs</i>	<i>None</i>	<i>Mild</i>	<i>Mod</i>	<i>Severe</i>
<i>Pre</i>	21	76.19	9.52	4.76	9.52
<i>1</i>	19	73.68	10.53	5.26	10.53
<i>2</i>	20	75.00	10.00	10.00	5.00
<i>3</i>	20	75.00	15.00	5.00	5.00
<i>4</i>	19	78.95	5.26	15.79	
<i>5</i>	18	77.78	22.22		
<i>6</i>	18	77.78	16.67	5.56	

DM – Severity of Sleep Disturbance in Yoga Group



DM – Severity of Sleep Disturbance in Control Group



Summary

The yoga group showed significant improvement in the symptoms of polyphagia and vision disturbances. In all other symptoms the changes were not significant. See Table 8.

Table 8: Diabetes – symptoms: statistical values

Y: n=21 C: n=25	F	df	Signifi- cance	Partial eta squared	Observed power
<i>Fatigue</i>	0.457	6.000	0.836	0.066	0.167
<i>Polyphagia</i>	3.169	6.000	0.013	0.328	0.875
<i>Sensory disturbance</i>	0.632	6.000	0.704	0.089	0.221
<i>Visual disturbance</i>	2.535	6.000	0.036	0.281	0.778
<i>Loss of weight</i>	0.363	6.000	0.898	0.053	0.139
<i>Quality of sleep</i>	0.540	6.000	0.775	0.077	0.192

C. Objective clinical observations

Four parameters were recorded every month. Mean of pre readings and monthly follow-up readings month-wise were calculated. See Table 9. This gave an idea of progressive responses in both groups. None of the four parameters showed much change over six months.

Table 9: Diabetes – clinical parameters: mean values

Y: n=21 C: n=25	Yoga				Control			
	<i>SBP</i>	<i>DBP</i>	<i>BMI</i>	<i>W/H</i>	<i>SBP</i>	<i>DBP</i>	<i>BMI</i>	<i>W/H</i>
<i>Pre</i>	141.81	86.95	24.38	0.990	140.40	88.00	26.25	0.914
<i>Mth 1</i>	140.86	86.31	24.22	0.990	141.28	86.24	26.25	0.915
<i>Mth 2</i>	139.43	85.52	24.06	0.988	144.40	87.04	26.23	0.908
<i>Mth 3</i>	141.81	87.29	24.23	0.988	143.12	87.36	26.18	0.909
<i>Mth 4</i>	139.43	85.33	24.13	0.989	138.64	86.00	26.19	0.911
<i>Mth 5</i>	140.57	87.33	23.98	0.983	144.32	87.36	26.20	0.909
<i>Mth 6</i>	142.10	85.10	23.92	0.984	145.20	86.80	26.16	0.913

Table 10: Diabetes – clinical parameters: statistical values

	F	df	Signifi- cance	Partial eta squared	Observed power
<i>SBP</i>	0.526	6.000	0.785	0.075	0.188
<i>DBP</i>	0.331	6.000	0.916	0.049	0.130
<i>BMI</i>	1.380	6.000	0.247	0.175	0.474
<i>W/H</i>	0.210	6.000	0.971	0.031	0.098

Summary

In the objective clinical observations both the systolic and the diastolic blood pressures showed very little change over pre level in the yoga as well as the control group. BMI and waist to hip circumference ratio also did not show much change in the two groups.

D. Laboratory Tests

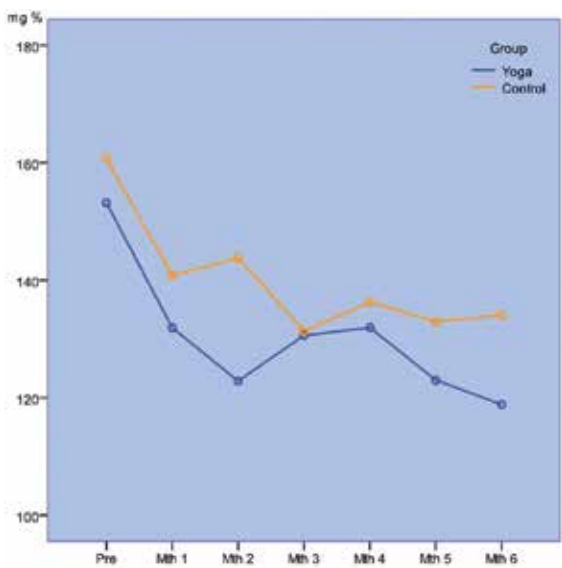
Subjects were monitored using six laboratory tests. Fasting and post-prandial glucose levels were done pre and every month for six months. Glycosylated haemoglobin (HbA1c), BUN, serum creatinine and lipid profile were done pre, after 3 months (mid) and post or at the end of six months.

Fasting blood sugar showed a downward trend in both groups but the reduction was more in the yoga group. See Table 11 and accompanying graphs. The difference between the two groups though was not significant. See Table 14.

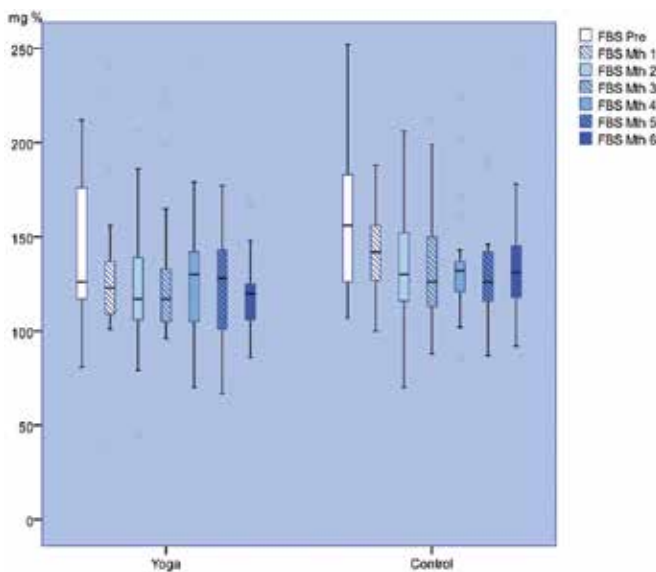
Table 11: Diabetes – fasting blood sugar

Y: n=21 C: n=25		Pre	Mth 1	Mth 2	Mth 3	Mth 4	Mth 5	Mth 6
Yoga	<i>Mean</i>	153.19	131.91	122.86	130.62	131.95	123.00	118.86
	<i>25 Percentile</i>	113.50	107.50	105.50	104.50	103.50	98.50	105.50
	<i>50 Percentile</i>	126.00	123.00	117.00	117.00	130.00	128.00	120.00
	<i>75 Percentile</i>	187.00	142.50	139.50	136.00	152.00	146.50	125.50
Control	<i>Mean</i>	160.72	140.80	143.80	131.32	136.28	132.96	134.08
	<i>25 Percentile</i>	122.50	126.50	116.00	108.50	119.50	113.50	115.00
	<i>50 Percentile</i>	156.00	142.00	130.00	126.00	132.00	126.00	131.00
	<i>75 Percentile</i>	183.50	156.00	152.00	150.50	140.00	143.50	147.00

Effect of Yoga on Fasting Blood Sugar in Diabetics



Effect of Yoga on Fasting Blood Sugar in Diabetics

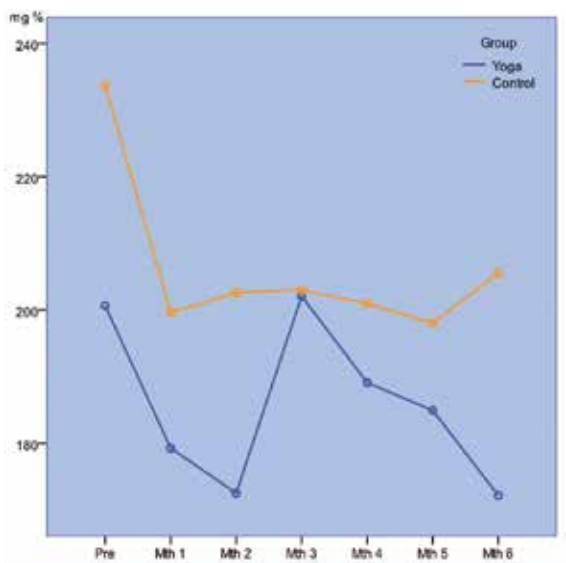


Blood sugar 2 hours after lunch (post-prandial) showed a downward trend of similar magnitude in both groups. The reduction was highest in the diabetics with high sugar levels in the yoga group. See Table 12 and accompanying graphs. The difference between the two groups was not statistically significant. See Table 14.

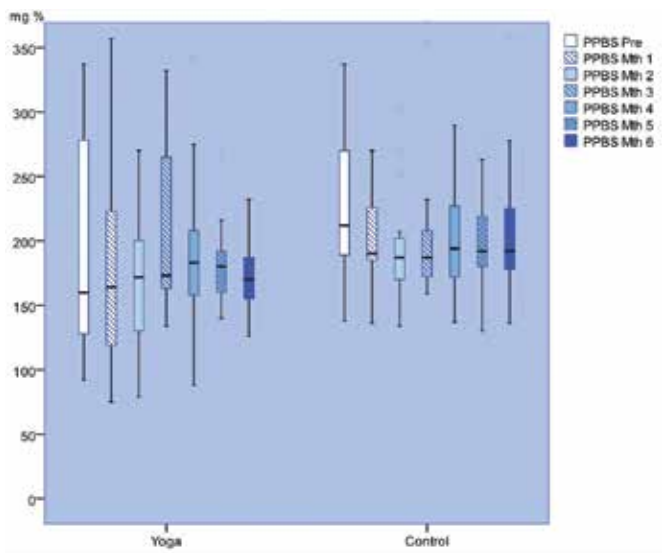
Table 12: Diabetes – post-prandial blood sugar

Y: n=21 C: n=25		Pre	Mth 1	Mth 2	Mth 3	Mth 4	Mth 5	Mth 6
Yoga	Mean	200.67	179.29	172.52	202.10	189.10	184.95	172.19
	25 Percentile	121.00	114.50	126.00	161.50	155.50	158.50	152.00
	50 Percentile	160.00	164.00	172.00	173.00	183.00	180.00	170.00
	75 Percentile	287.00	239.50	206.50	266.50	216.00	202.00	194.00
Control	Mean	233.72	199.68	202.60	203.08	200.96	198.04	205.56
	25 Percentile	188.00	183.50	169.00	171.50	170.00	179.00	173.00
	50 Percentile	212.00	190.00	187.00	187.00	194.00	192.00	192.00
	75 Percentile	278.50	227.00	204.50	209.00	237.50	221.00	230.00

Effect of Yoga on Post-Prandial Blood Sugar in Diabetics



Effect of Yoga on Post-Lunch Blood Sugar in Diabetics



Glycosylated haemoglobin (HbA1c) is a blood test that gives a broad picture of control of blood sugar levels in the previous three months. Less than 7% means good control of diabetes and in non-diabetic people it is generally about 6%. Both groups showed a similar trend of reduction in HbA1c. See Table 13 and accompanying graphs. The difference between the two groups was not statistically significant. See Table 14.

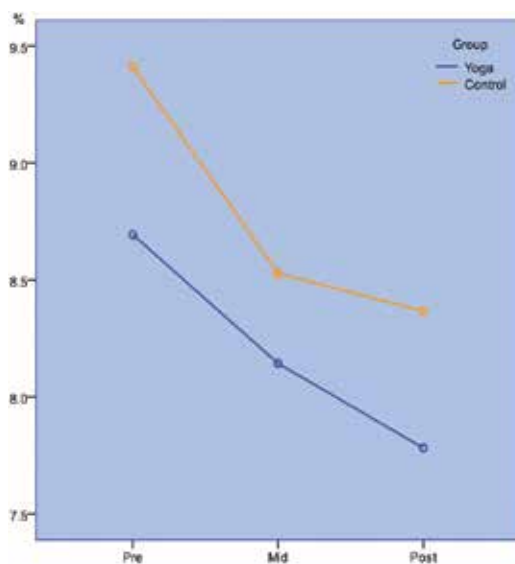
Table 13: Diabetes – glycosylated haemoglobin

Y: n=21 C: n=25		Pre	Month 3	Month 6
Yoga	<i>Mean</i>	8.69	8.14	7.78
	<i>25 Percentile</i>	8.09	7.30	7.45
	<i>50 Percentile</i>	8.80	7.90	7.60
	<i>75 Percentile</i>	9.75	9.03	8.39
Control	<i>Mean</i>	9.41	8.53	8.37
	<i>25 Percentile</i>	8.00	7.75	7.45
	<i>50 Percentile</i>	9.20	8.10	8.33
	<i>75 Percentile</i>	10.40	9.15	8.75

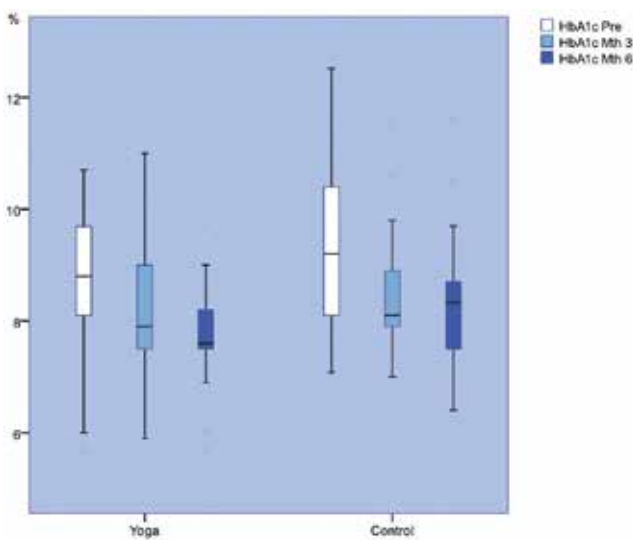
Table 14: Diabetes – blood sugar: statistical values

Y: n=21 C: n=25	F	df	Signifi- cance	Partial eta squared	Observed power
<i>Fasting Bl. Sugar</i>	1.013	6.000	0.431	0.135	0.350
<i>Post-Prandial Bl. Sugar</i>	2.258	6.000	0.058	0.258	0.720
<i>Glycosylated Hb</i>	0.451	2.000	0.640	0.021	0.119

Effect of Yoga on HbA1c in Diabetics



Effect of Yoga on HbA1c in Diabetics



Diabetics are at a risk of developing impairment of kidney function and deranged lipid profile that make them vulnerable to cardiac and vascular problems. Laboratory tests of kidney functions and lipid profile did not show any change in these parameters during the study period or any significant difference between the two groups. See Tables 15 and 16.

Table 15: Diabetes – kidney functions & lipid profile: mean values

Y: n=21 C: n=25	Yoga			Control		
	<i>Pre</i>	<i>Month 3</i>	<i>Month 6</i>	<i>Pre</i>	<i>Month 3</i>	<i>Month 6</i>
<i>BUN</i>	19.73	19.91	15.36	13.98	15.27	14.02
<i>S. Creatinine</i>	1.03	1.11	1.14	1.01	1.06	1.06
<i>S. Cholesterol</i>	207.50	199.50	195.50	200.50	211.50	201.17
<i>Triglyceride</i>	150.10	150.30	131.35	178.71	178.54	164.54
<i>HDL</i>	47.47	46.30	47.52	44.08	42.75	47.00
<i>LDL</i>	127.05	132.60	123.80	137.63	144.33	143.58

Table 16: Diabetes – kidney functions & lipid profile: statistical values

	F	df	Significance	Partial eta squared	Observed power
<i>BUN</i>	0.321	2.000	0.727	0.015	0.098
<i>S. Creatinine</i>	0.146	2.000	0.864	0.007	0.071
<i>S. Cholesterol</i>	1.243	2.000	0.299	0.057	0.25
<i>Triglyceride</i>	0.081	2.000	0.922	0.004	0.062
<i>HDL</i>	0.425	2.000	0.657	0.020	0.114
<i>LDL</i>	0.200	2.000	0.819	0.010	0.460

E. Medication

We were unable to maintain the record of this parameter and so it was dropped from the research design.

Summary of results

The regular practice of Satyananda Yoga over six months reduced two out of six common symptoms of diabetes, polyphagia (F 3.169 and Significance 0.013) and vision disturbances (F 2.535 and Significance 0.036) in the yoga group.

The cardinal parameters of this study were the fasting and post-prandial blood sugar levels and HbA1c. The fasting glucose level in the blood showed a downward trend in both groups, more so in the yoga group. The post-lunch blood sugar and HbA1c showed downward trends of similar magnitude in both groups. None of these changes showed a significant difference between the two groups.

Other laboratory tests and none of the four objective clinical observations reflecting risk factors showed neither any change nor any statistically significant difference between the two groups.

Conclusion

1. The research study could not support any of the following hypotheses.
2. In type II diabetic subjects' regular practice of Satyananda Yoga:
 - Reduces the symptoms – not proved
 - Reduces raised blood sugar levels and improves HbA1c – not proved
 - Reduces need for drug consumption – not studied
 - Reduces raised systolic and diastolic BP – not proved
 - Improves the risk factors like BMI & waist/hip circumference – not proved
 - Improves lipid profile – not proved.

Acknowledgements

We could undertake such a long study with success only with the blessings and inspiring force of our guru Paramahansa Swami Niranjanananda,

the broad, unconventional and progressive vision of then E.D. of BHEL, Bhopal, Shri P. T. Deo,

the dynamism and support of then President of HE Yoga Mitra Mandal, BHEL, Bhopal, Shri R.K. Shukla,

the full cooperation and encouragement of the management of BHEL and Kasturba Hospital,

the sincerity and hard work of the research co-ordinator Dr Smt Sarla Menon,

and all the doctors and staff of the Kasturba Hospital, BHEL, Bhopal,

the dedication, enthusiasm and hard work of yoga teachers of Yoga Research Center, BHEL, Bhopal, Shri Amaresh Kumar and Smt Pratima Prasad,

and the sincerity and regularity of all our participants.

DIABETES MELLITUS: TEACHING SCHEDULE FOR BHEL PROJECT

Class structure

Shanti mantras	5 mins
Shavasana	5 mins
Asana	25 mins
Talk	10 mins
Questions	5 mins
Pranayama	15 mins
Meditation	15 mins
Questions	5 mins
Shanti mantras	5 mins

- Asanas are to be repeated at least on three consecutive days.
- Only one or two new practices may be taught daily.
- Only one pranayama is to be introduced in a day.
- At least two pranyamas are to be revised daily.
- On the day of laghoo shankhaprakshalana, other yoga practices are not to be done.

Schedule

Week 1: PM 1, omit neck rotation in greeva sanchalanasana
Asanas of LSP
Vajrasana
Shavasana
Breath awareness

- Abdominal and yogic breathing
Kaya sthairyam with *Om* chanting
- Week 2:* Practices of week 1
PM 2 (half), omit jhulana lurhakanasana
Shashankasana
Makarasana
Padadhirasana
Nadi shodhana pranayama stage 1
Yoga nidra stages 1, 3, 4 and 8
Jala neti
- Week 3:* Practices of weeks 1 & 2
PM 2 (complete), omit jhulana lurhakanasana
Meru wakrasana
Swastikasana
Nadi shodhana pranayama stage 2 (alternate nostril breathing)
Bhramari pranayama
Yoga nidra stages 1, 2, 3, 4, 7 and 8
Antar mouna stage 1
Kunjla
- Week 4:* Practices of weeks 1 to 3
Chakki chalanasana
Nauka sanchalanasana
Kashta takshanasana
Siddha/siddhayoni asana
Ardha padmasana
Nadi shodhana pranayama stage 2 (counting the duration of breath)
Yoga nidra stages 1, 2, 3, 4, 6, 7 and 8
Laghoo shankhaprakshalana
- Week 5:* Practices of weeks 1 to 4
Surya namaskara
Janu sirshasana
Ardha matsyendrasana
Nadi shodhana pranayama stage 2 (equalizing inhalation and exhalation)
Antar mouna stage 2

Week 6: Practices of weeks 1 to 5

Saral dhanurasana

Ujjayi pranayama

Week 7: Practices of weeks 1 to 6

Paschimottanasana

Nadi shodhana pranayama stage 2 (lengthening the breath)

Kapalbhati pranayama

Ajapa japa in frontal passage

Week 8: Practices of weeks 1 to 7

Halasana

Eka pada pranamasana

Laghoo shankhaprakshalana, kunjla and jala neti are to be done once in fifteen days.

Suggestion:

- Encourage regularity in yogic practices and observance of yogic principles;
- Identify difficulties and help participants to solve them.

For the practices refer to *Asana Pranayama Mudra Bandha*, Yoga Publications Trust, Munger, Bihar, India.

Inconclusive Research

II: Basic Research

Shatkarma – Jala Neti, 2001

Introduction

Jala neti is a shatkarma, a hatha yoga cleansing practice, for the nose and throat area. It clears accumulated dirt and excess mucus from the nose, sinuses and throat. It opens both the nostrils wide and establishes a clear air passage for the breath. It has a calming and introverting effect on the mind and central nervous system. At the same time, it makes one more receptive and focused.

The head and face area has a rich supply of nerves carrying nerve impulses to and from the five sense organs situated there. Jala neti improves the functioning of the eyes, ears, nose and tongue by influencing the nadis, the pranic channels, and the nerves of the area and by gently stimulating *udana vayu*, the section of prana or life force which governs the five sense organs.

It is expected that when the mind is calm, under the influence of parasympathetic preponderance the pulse-rate and the blood pressure will decrease, the respiratory rate will come down and the body temperature will fall. The swara will change towards ida or sushumna dominance. The Peak Expiratory Flow Rate (PEFR) will improve with relaxed breathing and unobstructed nostrils. Yoga Research Foundation (YRF) conducted a study to observe some of the physiological effects of jala neti.

Method

70 participants of the Sannyasa Course 2001 served as subjects. They were all young or middle-aged healthy persons of both genders. The pre data was collected just before the practice and the post data after the preliminary drying of nostrils. The extensive techniques of drying the nostrils, shashankasana and kapalbhati shatkarma, were practised after the post data was collected. The results of this study are presented here.

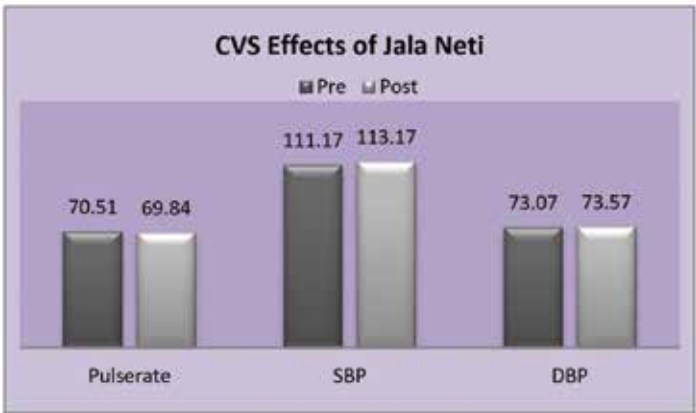
Results and discussion

As Graph 1 shows, contrary to expectation, the practice of jala neti did not change the pulse-rate or the systolic and diastolic blood pressures.

Table 1: CV system effects of jala neti

N=70	Pre	Post
<i>Pulse-rate</i>	70.51	69.84
<i>Systolic BP</i>	111.17	113.17
<i>Diastolic BP</i>	73.07	73.57

Graph 1

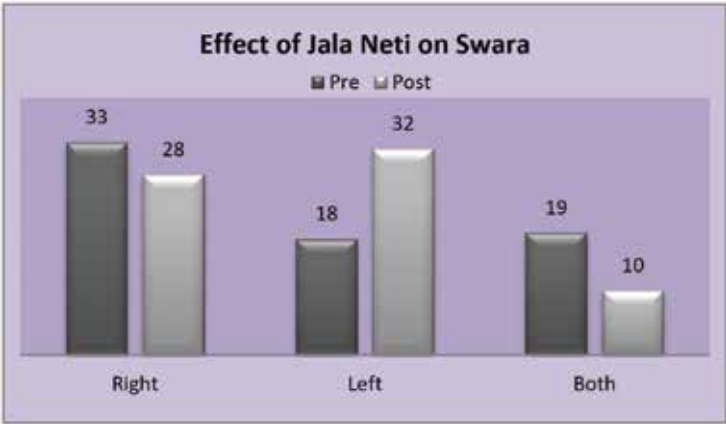


As shown in Graph 2, preponderance of right swara changed in favour of left swara indicating introversion, relaxation, parasympathetic dominance and right cerebral hemisphere activity. It was surprising to notice that the incidence of both nostrils flowing equally, or sushumna dominance, reduced in favour of left nostril dominance. Active sushumna nadi indicates balance, calm alertness and a meditative state. Table 2 shows that in 18 subjects out of 70 swara changed towards the left nostril. The total number of subjects having left swara flow after the practice of jala neti was 32 out of 70.

Table 2: Pattern of swara in jala neti

Swara	Pre	Post	Changed to
<i>Right</i>	33	28	8
<i>Left</i>	18	32	18
<i>Both</i>	19	10	7

Graph 2



Contrary to expectation the respiratory rate showed a rise after the practice of jala neti. Other parameters did not show any significant change. They are summarized in Table 3.

Table 3: Non-CVS physiological changes in jala neti

N=70	Pre	Post
<i>Body temp in degrees C</i>	36.24	36.26
<i>Resp rate/min</i>	18.53	21.46
<i>PEFR in litres/min</i>	435.00	443.10
<i>Body wt in kgs</i>	53.95	53.87

Conclusion

The practice of jala neti has an introverting, calming effect on the mind. This is reflected in the change of swara from right to left. The effects on the cardiovascular system, body temperature, breath-rate, PEFr and body weight were found to be negligible in this study on healthy subjects.

Shatkarma – Physiological Effects of Laghoo Shankhaprakshalana (LSP) versus Laghoo Shankhaprakshalana with Kunjal and Jala Neti, 2002

Summary

In this study, the effects of LSP were compared with LSP followed by kunjal and neti in 20 diabetics. The changes in body weight, pulse-rate, SBP & DBP and swara were found to be similar.

Study

15 type II diabetics of the Health Management Course, May 2002 at Ganga Darshan, were studied for the cardiovascular effects of only LSP and LSP followed by kunjal and neti.

The increase in body weight was similar in the participants of both groups until the end of LSP but 2 hours after all the practices the LSP+K+N group had larger water retention. By the end of 4 hours post practice this weight gain had leveled out.

The pulse-rate rose after LSP and rose further after kunjal due to physical exertion and sympathetic effect. After the practice of neti it started decreasing due to the relaxing and parasympathetic effects of the three practices. The pulse-rate came down to pre levels at the end of 3 hours. The rise was more in the LSP group and it took longer to come to base level.

The systolic BP rose after LSP due to physical exertion and sympathetic effect. It decreased after kunjal and remained steady after the practice of neti due to the relaxing and parasympathetic effects of all the three practices together. In less than 2 hours it dropped to less than pre level and was maintained at a lower level until the end of the study time. Both groups showed a similar pattern.

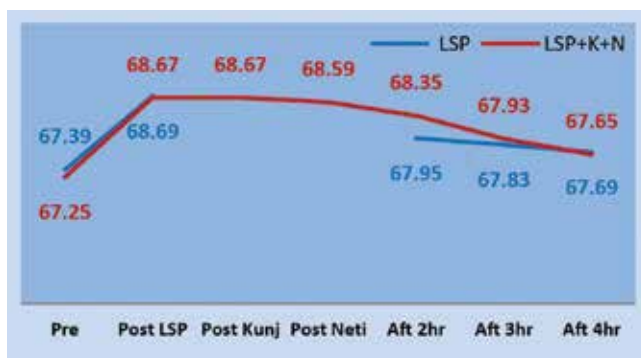
The diastolic BP rose after LSP and remained steady at an elevated level after kunjal due to physical exertion and sympathetic effect. After the practice of neti it started decreasing and reached below pre level within 2 hours due to the relaxing and parasympathetic effects of all the three practices together. It bounced back to pre levels within the next 1–2 hours. Both groups showed a similar pattern.

The effects on body weight, pulse-rate, SBP & DBP had no clinically significant difference between the two groups.

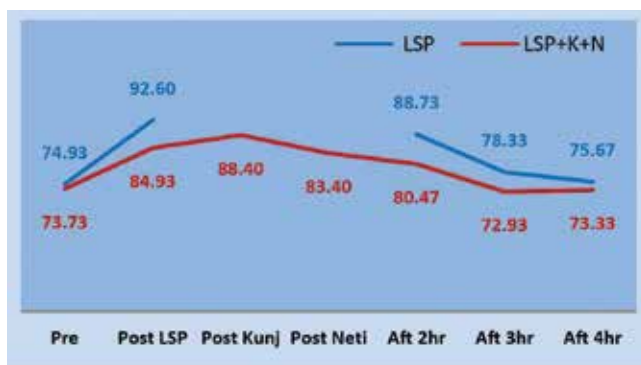
Table 1 Physiological effects of shatkarmas

n=15+15	Pre	Post LSP	Post kunjal	Post neti	After 2 hrs	After 3 hrs	After 4 hrs
Body weight							
<i>LSP</i>	67.39	68.69	*	*	67.95	67.83	67.69
<i>LSP+K+N</i>	67.25	68.67	68.67	68.59	68.35	67.93	67.65
Pulse-rate							
<i>LSP</i>	74.93	92.60	*	*	88.73	78.33	75.67
<i>LSP+K+N</i>	73.73	84.93	88.40	83.40	80.47	72.93	73.33
Systolic BP							
<i>LSP</i>	127.00	145.20	*	*	123.13	123.80	129.53
<i>LSP+K+N</i>	129.07	138.20	129.27	130.40	124.67	128.93	125.80
Diastolic BP							
<i>LSP</i>	82.07	87.60	*	*	79.80	81.87	82.60
<i>LSP+K+N</i>	83.13	88.27	87.40	85.47	81.80	83.33	84.40

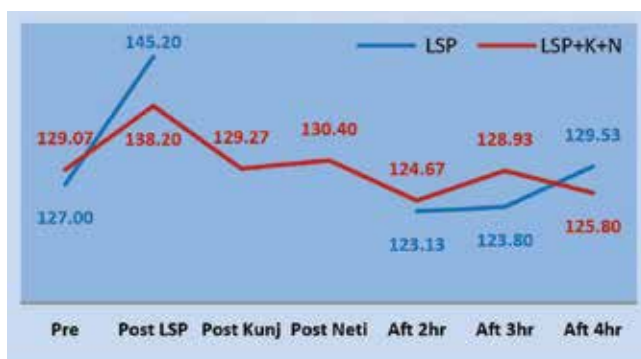
Effect of Shatkarmas on Body Weight



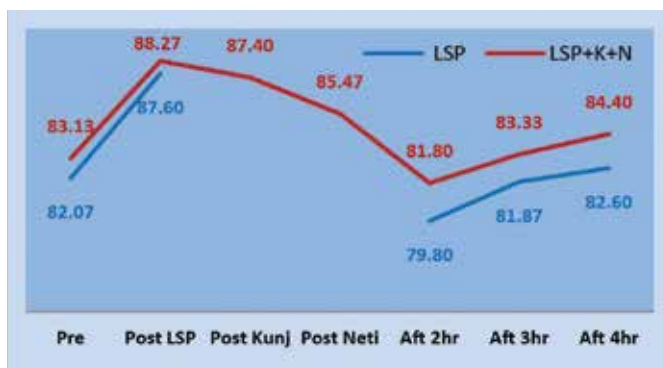
Effect of Shatkarmas on Pulse-Rate



Effect of Shatkarmas on Systolic BP



Effect of Shatkarmas on Diastolic BP

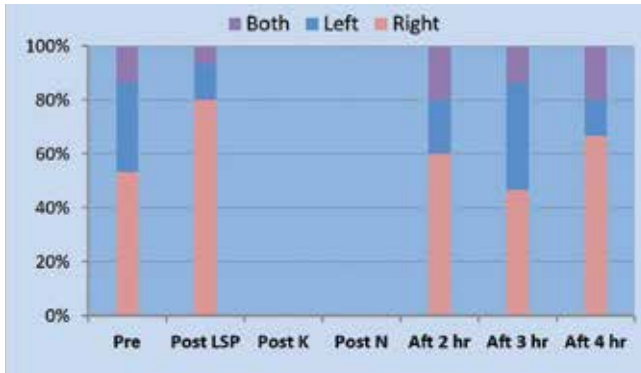


As expected both LSP and kunjal led to pingala activity. In the 'only LSP' group pingala activity continued to dominate. In the 'LSP with kunjal and neti' group, pingala activity was maximum after kunjal but after neti it changed to ida and continued until the end of the study time.

Table 2: Pattern of swara in shatkarmas

	Pre	Post LSP	Post K	Post N	Aft 2 hr	Aft 3 hr	Aft 4 hr
n=15	LSP						
Right	8	12	*	*	9	7	10
Left	5	2	*	*	3	6	2
Both	2	1	*	*	3	2	3
n=15	LSP + Kunjal + Neti						
Right	8	8	12	7	9	6	6
Left	5	4	1	6	5	7	7
Both	2	3	2	2	1	2	2

Effect of LSP on Swara



Effect of LSP + Kunjal + Neti on Swara



Conclusion

In diabetic subjects the changes in body weight, pulse-rate, systolic and diastolic BP and swara were similar in the two groups: one group only did LSP, and the other group did LSP with kunjal kriya and jala neti.

The specific effect of kunjal kriya was stimulating pingala dominance and a minor rise in pulse-rate. In contrast, the systolic BP came down.

The specific effect of jala neti was pacifying, a reduction of pulse-rate and diastolic BP, and an increase in ida activity.

Classical Asanas, 2002–2004

Study 1

The post-graduate students of Bihar Yoga Bharati, Munger, were encouraged by Yoga Research Foundation (YRF) to study objectively the simple effects of yogic practices. As part of this objective the cardiovascular effects of the classical asanas were recorded in January 2004 on 32 students of the 2002–04 batch. Each student was allowed to choose the classical asana they wanted to perfect over a period of three months. Ardha matsyendrasana and a non-classical asana, greeva sanchalanasana were studied on the participants of health management courses of March 2003, with 8 participants, and April 2003 with 70 participants.

Three parameters, pulse-rate per minute, systolic and diastolic blood pressure in mm of mercury, and swara, the prominence of flow in the right or left nasal airway, were observed just before the practice and on release of the posture. The classical asanas were practised only one round and were held for a comfortable period of time. Greeva sanchalanasana was practised for five rounds. The t-test statistics was used to calculate significance of the results obtained.

Results

The data is presented in Tables 1 and 2. Some asanas were stimulating pingala nadi or sympathetic nervous system. The systolic BP and/or pulse-rate showed a trend to rise and the swara changed towards the right nostril, for example in chakrasana. However, with most asanas the picture was mixed. Almost all asanas showed a fall in diastolic BP. The highlighted data shows either statistically significant or clinically interesting values in that group. The individual asanas are discussed subsequently in greater detail. Unfortunately the number of subjects for each asana was very small. Table 3 presents the summary of the findings.

Table 1: CVS effects of classical asanas

	Asana	n	SBP			DBP			Pulse		
			Pre	Post	Signi.	Pre	Post	Signi.	Pre	Post	Sig.
1	Ardha matsyendrasa	70	110.34	107.61	0.127	72.93	72.16	0.267	71.37	73.49	0.004
2	Koormasana	15	109.00	105.07	0.074	72.47	70.20	0.208	69.53	70.13	0.778
3	Sarvangasana	15	123.40	117.67	0.072	77.60	70.33	0.001	72.00	73.07	0.549
4	Baka dhyanasana	9	115.22	118.33	0.403	77.67	74.44	0.236	80.56	80.11	0.896
5	Chakrasana	9	115.00	120.22	0.211	73.67	72.33	0.634	79.00	88.89	0.024
6	Natarajasana	9	109.67	109.11	0.752	73.56	72.89	0.753	73.22	70.56	0.344
7	Greeva sanchalanasana	8	145.38	140.50	0.092	95.63	92.25	0.146	76.50	74.00	0.305
8	Poorna dhanurasana	6	120.17	121.17	0.654	73.67	71.83	0.168	67.50	71.33	0.133
9	Sirshasana	6	122.83	121.67	0.798	78.33	72.17	0.006	82.00	80.67	0.707
10	Vrischikasana	6	105.33	113.33	0.034	73.33	67.00	0.220	68.67	77.67	0.224
11	Hamsasana	3	95.67	98.00	0.192	62.00	59.67	0.369	66.33	66.67	0.918
12	Hanumanasana	3	133.00	130.00	0.777	81.67	79.33	0.465	69.67	70.67	0.678
13	Kukkutasana	3	104.00	105.33	0.383	71.67	66.33	0.047	64.67	71.00	0.502
14	Paschimottanasana	3	93.67	100.67	0.073	68.67	65.67	0.430	73.67	74.33	0.957
15	Poorna natarajasana	3	101.67	100.33	0.919	71.00	66.00	0.243	73.33	78.67	0.026

Table 2: Effect of classical asanas on swara

	Asana	n	Swara Pre			Swara Post		
			Right	Left	Both	Right	Left	Both
1	<i>Ardha matsyendrasana</i>	70	16	34	20	13	28	29
2	<i>Koormasana</i>	15	5	6	4	6	3	6
3	<i>Sarvangasana</i>	15	6	5	4	9	4	2
4	<i>Baka dhyanasana</i>	9	2	3	4	1	3	5
5	<i>Chakrasana</i>	9	4	2	3	6	3	0
6	<i>Natarajasana</i>	9	2	3	4	1	5	3
7	<i>Greeva sanchalanasana</i>	8	na	na	na	na	na	na
8	<i>Poorna dhanurasana</i>	6	3	1	2	4	0	2
9	<i>Sirshasana</i>	6	3	2	1	6	0	0
10	<i>Vrischikasana</i>	6	5	1	0	3	1	2
11	<i>Hamsasana</i>	3	0	2	1	0	2	1
12	<i>Hanumanasana</i>	3	3	0	0	3	0	0
13	<i>Kukkutasana</i>	3	1	2	0	1	2	0
14	<i>Paschimottanasana</i>	3	3	0	0	2	1	0
15	<i>Poorna natarajasana</i>	3	2	1	0	2	1	0

Table 2a: Ardha matsyendrasana

n=70		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	110.34	10.72	0.127	102.75	110.50	119.00
	Post	107.61	17.03		101.00	108.00	116.25
DBP	Pre	72.93	6.96	0.267	68.00	72.50	77.00
	Post	72.16	7.44		67.00	71.00	77.00
Pulse-rate	Pre	71.37	10.18	0.004	65.00	70.50	78.25
	Post	73.49	10.81		66.75	73.50	79.25
Swara	Pre	16R, 34L, 20B					
	Post	13R, 28L, 29B					

- Insignificant reduction in SBP, stable DBP, significant (0.004) rise in PR & tendency towards balanced swara.
- **Stabilizing effect.**

Cardiovascular Effects of Ardha Matsyendrasana

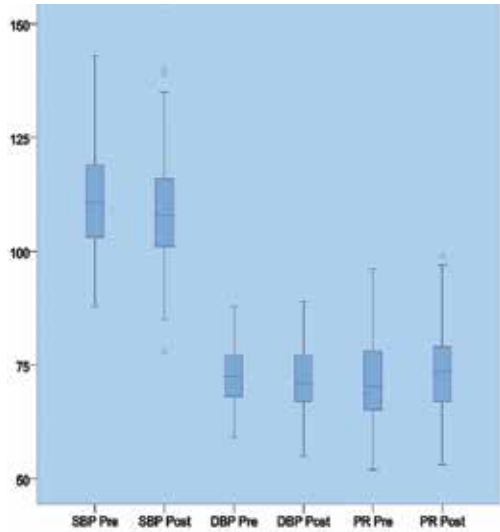


Table 2b: Koormasana

n=15		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	109.00	20.99	0.074	93.00	101.00	115.00
	Post	105.07	19.03		91.00	97.00	112.00
DBP	Pre	72.47	13.64	0.208	65.00	69.00	73.00
	Post	70.20	12.86		61.00	65.00	81.00
Pulse-rate	Pre	69.53	7.92	0.778	62.00	68.00	76.00
	Post	70.13	5.57		66.00	70.00	75.00
Swara	Pre	5R, 6L, 4B					
	Post	6R, 3L, 6B					

- Less than significant (0.074) reduction in SBP, insignificant fall in DBP, stable PR & tendency away from left swara.
- **Stabilizing effect.**

Cardiovascular Effects of Koormasana

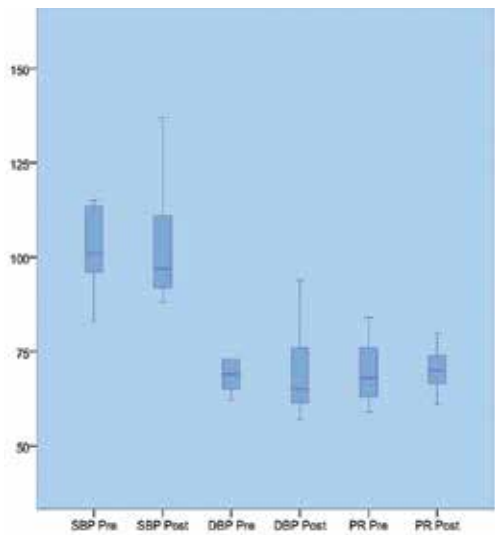


Table 2c: Sarvangasana

n=15		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	123.40	19.36	0.072	108.00	120.00	136.00
	Post	117.67	14.45		103.00	117.00	126.00
DBP	Pre	77.60	9.73	0.001	71.00	74.00	87.00
	Post	70.33	4.76		66.00	70.00	75.00
Pulse-rate	Pre	72.00	11.08	0.549	66.00	74.00	81.00
	Post	73.07	13.19		66.00	73.00	82.00
Swara	Pre	6R, 5L, 4B					
	Post	9R, 4L, 2B					

- Less than significant (0.072) but substantial reduction in SBP, highly significant (0.001) reduction in DBP, stable PR & tendency towards right swara.
- **Stimulating swara pattern – pacifying CVS effect** due to activation of carotid body reflex (cranial protection).

Cardiovascular Effects of Sarvangasana

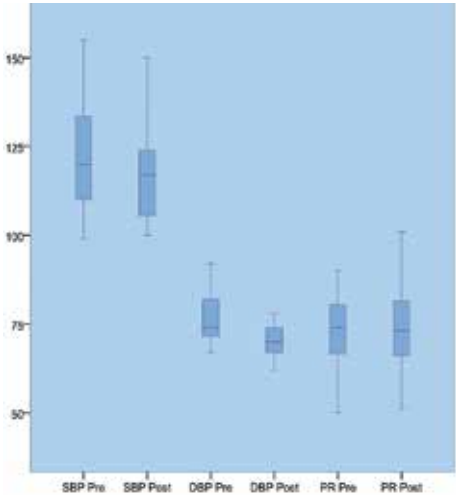


Table 2d: Baka dhyanasana

n=9		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	115.22	17.25	0.403	101.50	120.00	126.50
	Post	118.33	13.21		109.50	117.00	129.50
DBP	Pre	77.67	11.75	0.236	70.00	75.00	81.50
	Post	74.44	7.04		69.50	72.00	78.00
Pulse-rate	Pre	80.56	5.34	0.896	76.00	82.00	84.50
	Post	80.11	7.54		75.00	79.00	86.50
Swara	Pre	2R, 3L, 4B					
	Post	1R, 3L, 5B					

- Insignificant rise in SBP, insignificant reduction in DBP, stable PR & swara.
- **Stabilizing effect.**

Cardiovascular Effects of Baka Dhyanasana

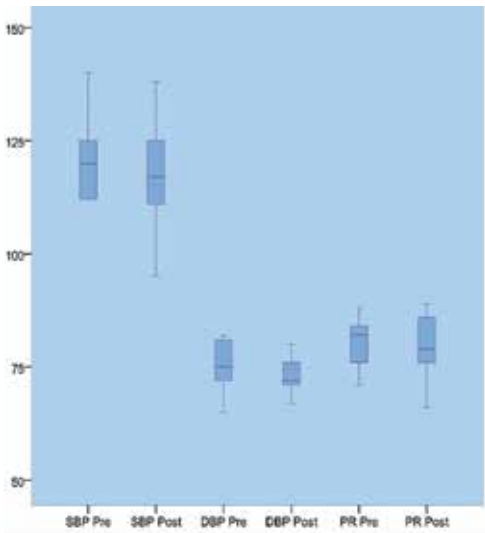


Table 2e: Chakrasana

n=9		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	115.00	16.12	0.211	100.50	112.00	128.50
	Post	120.22	18.16		104.00	116.00	141.50
DBP	Pre	73.67	9.81	0.634	65.50	72.00	85.00
	Post	72.33	14.50		58.50	72.00	85.50
Pulse-rate	Pre	79.00	7.84	0.024	71.50	79.00	83.00
	Post	88.89	13.97		78.50	85.00	96.50
Swara	Pre	4R, 2L, 3B					
	Post	6R, 3L, 0B					

- Less than significant (0.211) but substantial rise in SBP, stable DBP, significant (0.024) rise in PR & tendency towards right swara.
- **Stimulating effect.**

Cardiovascular Effects of Chakrasana

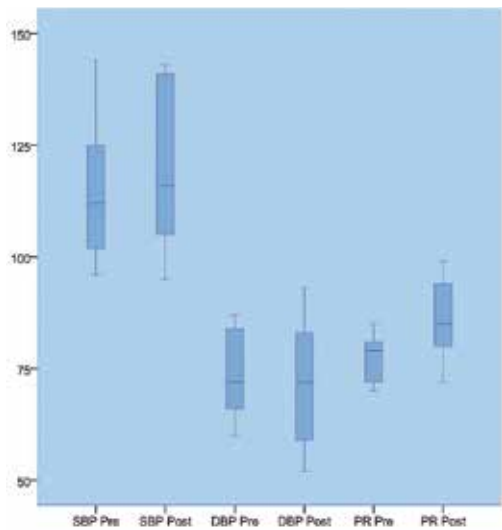


Table 2f: Natarajasana

n=9		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	109.67	6.23	0.752	105.50	110.00	113.50
	Post	109.11	4.86		107.00	107.00	112.00
DBP	Pre	73.56	6.77	0.753	67.00	75.00	79.00
	Post	72.89	6.41		68.00	72.00	79.00
Pulse-rate	Pre	73.22	4.58	0.344	69.50	74.00	77.50
	Post	70.56	11.04		67.50	72.00	78.50
Swara	Pre	2R, 3L, 4B					
	Post	1R, 5L, 3B					

- Stable SBP & DBP, insignificant reduction in PR & tendency towards left swara.
- **Introverting effect.**

Cardiovascular Effects of Natarajasana

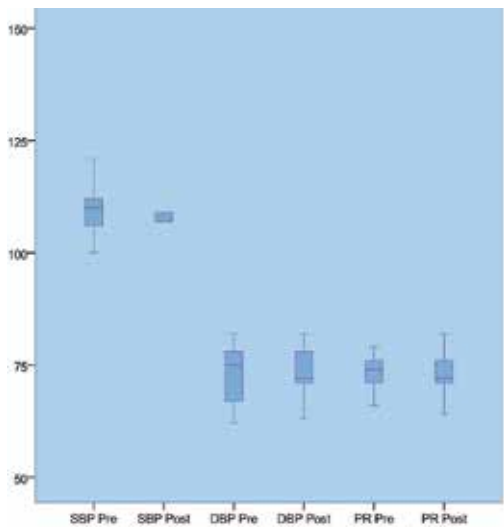


Table 2g: Greeva sanchalanasana

n=8		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	145.38	19.92	0.092	131.25	140.00	160.00
	Post	140.50	17.62		130.00	140.00	155.00
DBP	Pre	95.63	12.37	0.146	86.25	95.00	100.00
	Post	92.25	9.05		86.25	90.00	97.25
Pulse-rate	Pre	76.50	11.40	0.305	66.00	78.00	83.00
	Post	74.00	9.07		69.00	76.00	80.00
Swara	Pre	Not available					
	Post	Not available					

- Less than significant reduction in SBP, DBP & PR. Swara data is not available.
- **Calming effect.**

Cardiovascular Effects of Greeva Sanchalanasana

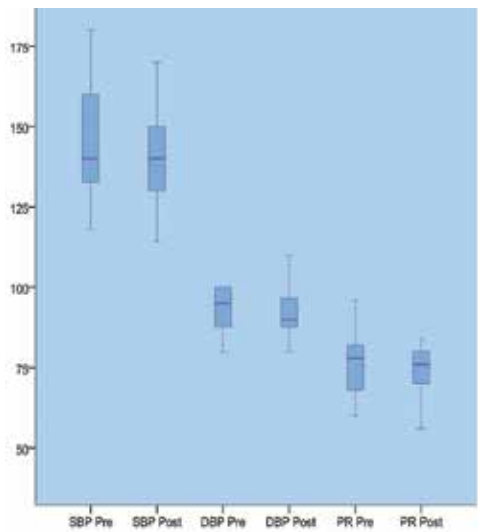


Table 2h: Poorna dhanurasana

n=6		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	120.17	13.93	0.654	108.75	117.00	132.50
	Post	121.17	18.73		103.75	117.50	137.75
DBP	Pre	73.67	10.52	0.168	65.50	71.00	81.50
	Post	71.83	9.17		63.75	70.00	80.50
Pulse-rate	Pre	67.50	5.32	0.133	61.75	68.00	72.00
	Post	71.33	5.50		65.50	72.00	76.50
Swara	Pre	3R, 1L, 2B					
	Post	4R, 0L, 2B					

- Stable SBP, insignificant reduction in DBP, less than significant rise in PR & tendency towards right swara.
- **Stimulating effect.**

Cardiovascular Effects of Poorna Dhanurasana

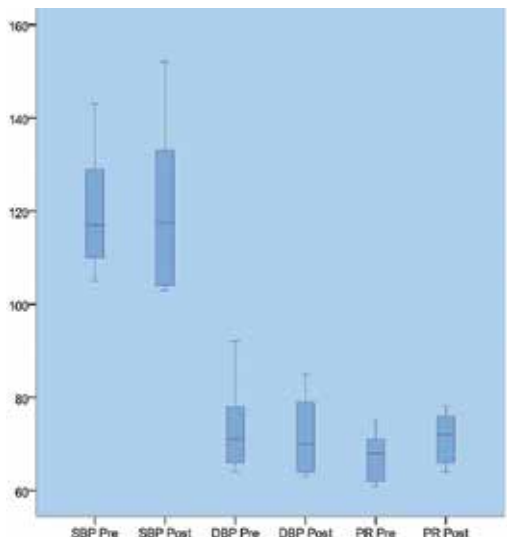


Table 2i: Sirshasana

n=6		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	122.83	28.83	0.798	97.75	116.50	152.75
	Post	121.67	26.76		97.75	120.50	145.00
DBP	Pre	78.33	14.10	0.006	65.00	77.50	93.25
	Post	72.17	16.02		56.75	72.00	87.50
Pulse-rate	Pre	82.00	7.48	0.707	74.50	83.00	89.00
	Post	80.67	4.55		76.75	79.50	85.00
Swara	Pre	3R, 2L, 1B					
	Post	6R, 0L, 0B					

- Stable SBP & PR, significant (0.006) reduction in DBP and tendency towards right swara.
- **Calming effect with alertness.**

Cardiovascular Effects of Sirshasana

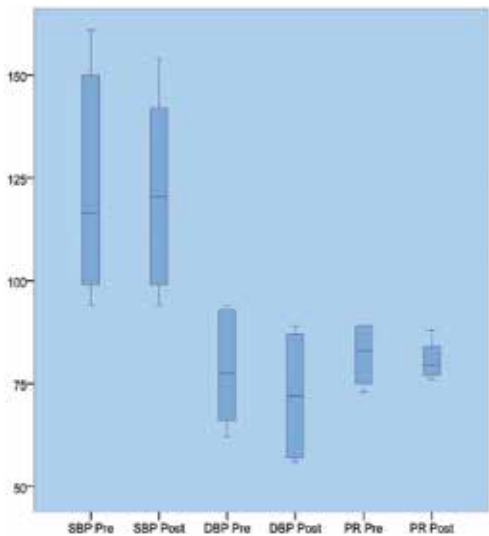


Table 2j: Vrischikasana

n=6		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	105.33	12.85	0.034	95.75	103.00	116.25
	Post	113.33	12.74		100.00	117.50	122.75
DBP	Pre	73.33	14.29	0.220	59.75	70.00	88.75
	Post	67.00	6.57		62.50	66.50	71.25
Pulse-rate	Pre	68.67	14.83	0.224	54.75	67.50	79.00
	Post	77.67	4.55		74.75	77.50	80.50
Swara	Pre	5R, 1L, 0B					
	Post	3R, 1L, 2B					

- Significant (0.034) rise in SBP, less than significant (0.220) but substantial reduction in DBP, less than significant (0.224) but substantial rise in PR & tendency towards right swara. ‘n’ too small to give authentic significance value.
- **Stimulating effect.**

Cardiovascular Effects of Vrischikasana

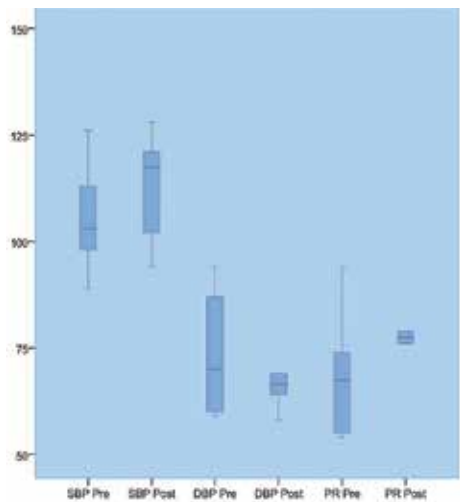


Table 2k: Hamsasana

n=3		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	95.67	4.93	0.192	94.00	98.00	98.50
	Post	98.00	3.61		96.50	99.00	100.00
DBP	Pre	62.00	5.00	0.369	59.50	62.00	64.50
	Post	59.67	4.16		58.00	61.00	62.00
Pulse-rate	Pre	66.33	4.51	0.918	64.00	66.00	68.50
	Post	66.67	2.31		66.00	68.00	68.00
Swara	Pre	OR, 2L, 1B					
	Post	OR, 2L, 1B					

- Less than significant rise in SBP, less than significant reduction in DBP, stable PR & swara.
- **Stabilizing effect.**

Cardiovascular Effects of Hamsasana

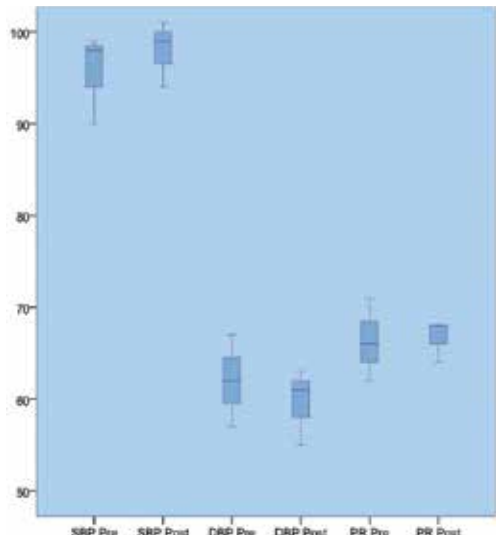


Table 2l: Hanumanasana

n=3		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	133.00	3.61	0.777	131.00	132.00	134.50
	Post	130.00	12.53		124.00	131.00	136.50
DBP	Pre	81.67	4.16	0.465	80.00	83.00	84.00
	Post	79.33	8.62		75.50	81.00	84.00
Pulse-rate	Pre	69.67	5.13	0.678	67.50	71.00	72.50
	Post	70.67	2.52		69.50	71.00	72.00
Swara	Pre	3R, OL, OB					
	Post	3R, OL, OB					

- Less than significant fall in SBP and DBP, stable PR & swara.
- **Stabilizing effect.**

Cardiovascular Effects of Hanumanasana

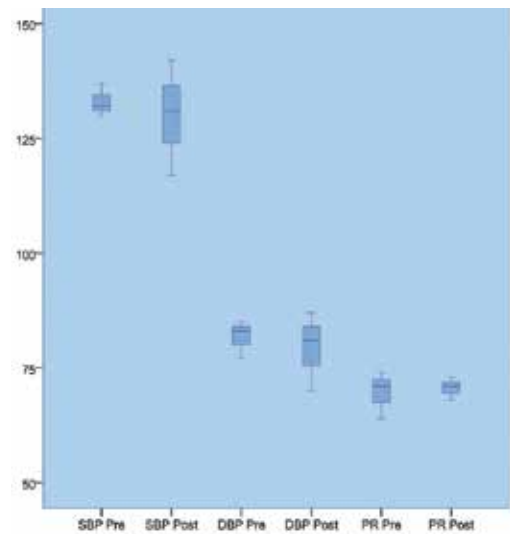


Table 2m: Kukkutasana

n=3		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	104.00	2.65	0.383	102.50	103.00	105.00
	Post	105.33	4.51		103.00	105.00	107.50
DBP	Pre	71.67	2.08	0.047	70.50	71.00	72.50
	Post	66.33	4.04		64.00	64.00	67.50
Pulse-rate	Pre	64.67	4.16	0.502	63.00	66.00	67.00
	Post	71.00	9.54		66.50	72.00	76.00
Swara	Pre	1R, 2L, 0B					
	Post	1R, 2L, 0B					

- Stable SBP, significant (0.047) reduction in DBP, less than significant (0.502) but substantial rise in PR & stable swara.
- **Introverting effect.**

Cardiovascular Effects of Kukkutasana

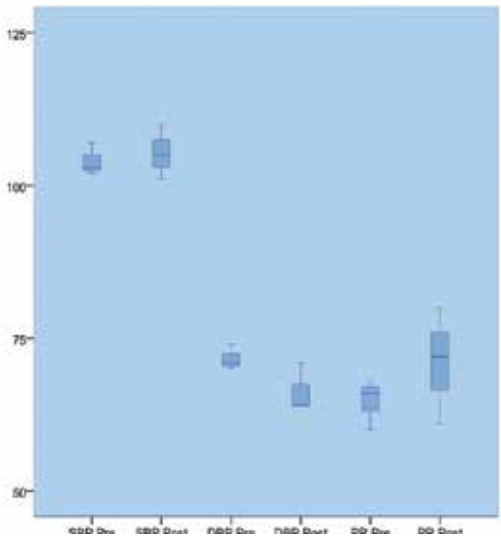


Table 2n: Paschimottanasana

n=3		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	93.67	17.47	0.073	84.00	89.00	101.00
	Post	100.67	15.14		92.00	94.00	106.00
DBP	Pre	68.67	15.89	0.430	59.50	60.00	73.50
	Post	65.67	10.79		59.50	61.00	69.50
Pulse-rate	Pre	73.67	19.14	0.957	63.50	71.00	82.50
	Post	74.33	2.89		73.50	76.00	76.00
Swara	Pre	3R, 0L, 0B					
	Post	2R, 1L, 0B					

- Less than significant (0.073) but substantial rise in SBP, less than significant reduction in DBP, stable PR & swara.
- **Stimulating effect.**

Cardiovascular Effects of Paschimottanasana

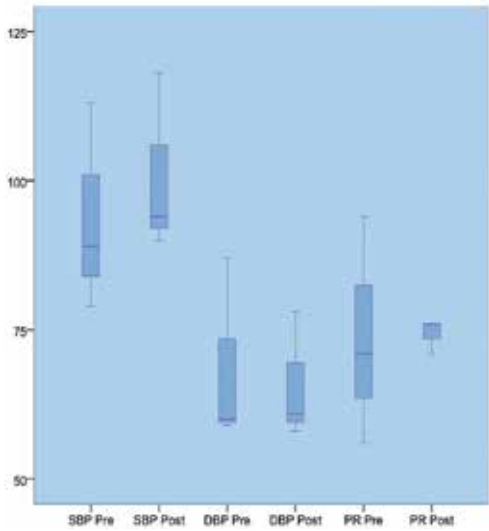


Table 2o: Poorna natarajasana

n=3		Mean	Std dev	Significance	25 percentile	50 percentile	75 percentile
SBP	Pre	101.67	10.97	0.919	95.50	98.00	106.00
	Post	100.33	11.06		94.50	99.00	105.50
DBP	Pre	71.00	6.08	0.243	67.50	68.00	73.00
	Post	66.00	1.00		65.50	66.00	66.50
Pulse-rate	Pre	73.33	9.87	0.026	70.00	78.00	79.00
	Post	78.67	8.39		76.00	83.00	83.50
Swara	Pre	2R, 1L, 0B					
	Post	2R, 1L, 0B					

- Stable SBP, less than significant (0.243) but substantial reduction in DBP, significant (0.026) rise in PR & stable swara.
- **Stimulating effect.**

Cardiovascular Effects of Poorna Natarajasana

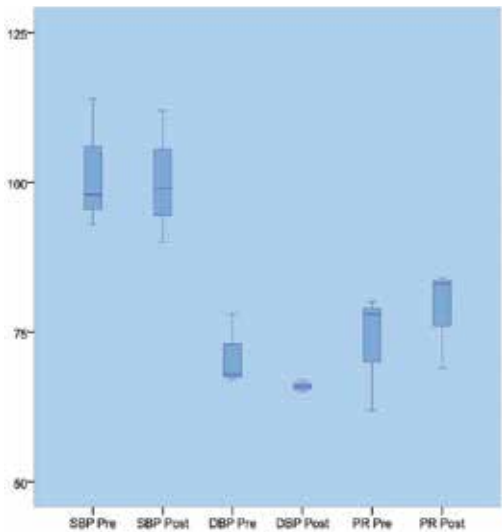


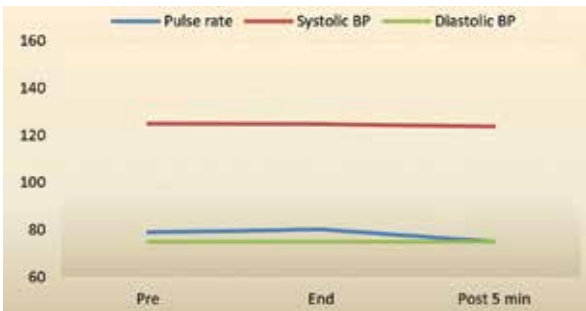
Table 3: Summary of effects of classical asanas (values in brackets show statistical significance)

	Asana	SBP	DBP	PR	Swara	Remark
1	<i>Ardha matsyendrasana</i>			↑(0.004)	Towards both	Stabilizing
2	<i>Koormasana</i>	↓			Away from L	Stabilizing
3	<i>Sarvangasana</i>	↓	↓(0.001)		Towards R	Calming with alertness
4	<i>Baka dhyanasana</i>					Stabilizing
5	<i>Chakrasana</i>	↑		↑(0.024)	Towards R	Stimulating
6	<i>Natarajasana</i>				Towards L	Introverting
7	<i>Greeva sanchalanasana</i>	↓	↓	↓		Calming
8	<i>Poorna dhanurasana</i>			↑	Towards R	Stimulating
9	<i>Sirshasana</i>		↓(0.006)		Towards R	Calming with alertness
10	<i>Vrischikasana</i>	↑(0.034)	↓		Towards R	Stimulating
11	<i>Hamsasana</i>	↑	↓			Stabilizing
12	<i>Hanumanasana</i>	↓	↓			Stabilizing
13	<i>Kukkutasana</i>		↓(0.047)			Introverting
14	<i>Paschimottanasana</i>	↑	↓			Stimulating
15	<i>Poorna Natarajasana</i>		↓	↑(0.026)		Stimulating

Study 2

In the year 2006, several yoga therapy research studies were conducted at the Yoga Research Center, Kasturba Hospital, BHEL, Bhopal, India, in collaboration with Yoga Research Foundation (YRF). The cardiovascular effects of chakki chalanasana and nauka sanchalanasana were studied on research groups with diabetes and hypertension. In the hypertension group the pulse-rate stayed stable and systolic BP decreased after 5 minutes of 10 rounds of chakki chalanasana and also after 10 rounds of nauka sanchalanasana. With chakki chalanasana the diastolic BP decreased considerably. See Tables 4 and 5 and the accompanying graphs. The group with normal BP was too small to draw any conclusion.

Effects of Chakki Chalanasana on CVS – Normal BP



Effects of Chakki Chalanasana on CVS – High BP

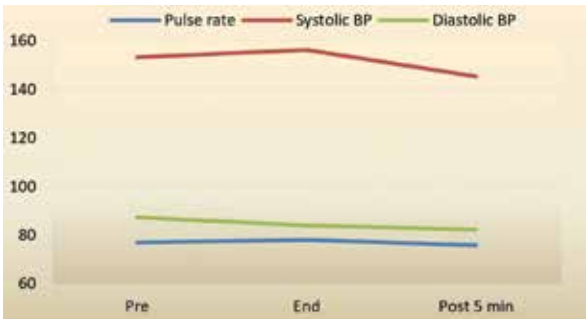


Table 4: Effects of chakki chalanasana on cardiovascular system

	Normal BP (n=4)				
	<i>Pre</i>	<i>End</i>	<i>Post 5 min</i>	<i>Significance Pre:End</i>	<i>Significance Pre:Post 5 min</i>
<i>Pulse-rate</i>	79.00	80.25	75.00	Not Applicable	
<i>SBP</i>	125.00	124.75	123.75		
<i>DBP</i>	75.00	75.00	75.00		

	High BP (n=28)				
	<i>Pre</i>	<i>End</i>	<i>Post 5 min</i>	<i>Significance Pre:End</i>	<i>Significance Pre:Post 5 min</i>
<i>Pulse-rate</i>	77.04	78.11	75.93	0.302630	0.133249
<i>SBP</i>	153.21	156.25	145.39	0.171753	0.001325
<i>DBP</i>	87.43	84.07	82.36	0.001401	0.000014

Table 5: Effects of nauka sanchalanasana on cardiovascular system

	Normal BP (n=9)				
	<i>Pre</i>	<i>End</i>	<i>Post 5 min</i>	<i>Significance Pre:End</i>	<i>Significance Pre:Post 5 min</i>
<i>Pulse-rate</i>	73.22	75.11	77.33	0.207930	0.030515
<i>SBP</i>	116.00	123.56	119.56	0.199192	0.421514
<i>DBP</i>	71.67	69.89	69.67	0.338448	0.404578

	High BP (n=27)				
	<i>Pre</i>	<i>End</i>	<i>Post 5 min</i>	<i>Significance Pre:End</i>	<i>Significance Pre:Post 5 min</i>
<i>Pulse-rate</i>	72.96	73.35	73.56	0.455400	0.499059
<i>SBP</i>	144.11	144.65	139.63	0.897863	0.062201
<i>DBP</i>	81.07	77.73	79.37	0.007871	0.170133

Discussion

Chakki chalanasana and nauka sanchalanasana are expected to stimulate pingala nadi and manipura chakra. This will be evident by a rise in systolic and diastolic BP and pulse-rate.

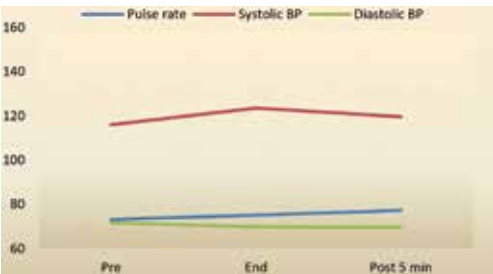
In chakki chalanasana there was an initial rise in SBP with a steady pulse-rate and a fall in DBP in the high blood pressure group, this is due to peripheral vasodilation following muscular activity.

In nauka sanchalanasana there was an initial rise in SBP and later a minor reduction in DBP due to peripheral vasodilation following muscular activity.

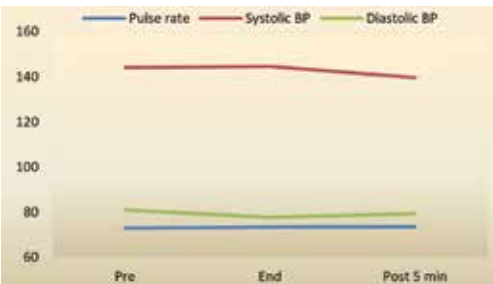
Conclusion

In hypertensive subjects the practice of chakki chalanasana showed initial rise in SBP but overall significant reduction in all three parameters. The practice of nauka sanchalanasana showed an overall significant reduction in SBP and DBP with steady pulse-rate.

Effects of Naukasanchalanasana on CVS – Normal BP



Effects of Naukasanchalanasana on CVS – High BP



Sheetali Pranayama, 2001

Summary

In 54 young healthy subjects sheetali pranayama was found to lower systolic and diastolic BP significantly. The pulse-rate and body temperature did not show much change. It stimulated balanced swara or sushumna activity.

Introduction

Sheetali and sheetakari pranayamas belong to the group of cooling pranayama. The breath is mechanically cooled during inhalation. The blood in the pulmonary circulatory system is directly exposed to this cool air and the coolness is transported instantaneously throughout the body. The individual feels relief from heat. It can help lower elevated body temperature. At the subtle level it reduces pitta prakriti and pingala activity. It is effective in reducing stress and related problems like acidity and high blood pressure.

Aim

To observe the physiological effects of sheetali pranayama.

Parameters

- | | | |
|-------------------------|-----------------------|-------------------------|
| 1. <i>Systolic BP:</i> | Digital BP instrument | Pre, post & after 5 min |
| 2. <i>Diastolic BP:</i> | Digital BP instrument | Pre, post & after 5 min |
| 3. <i>Pulse-rate:</i> | Digital BP instrument | Pre, post & after 5 min |
| 4. <i>Body temp:</i> | Digital thermometer | Pre, post & after 5 min |
| 5. <i>Swara:</i> | By hand | Pre, post & after 5 min |

Method

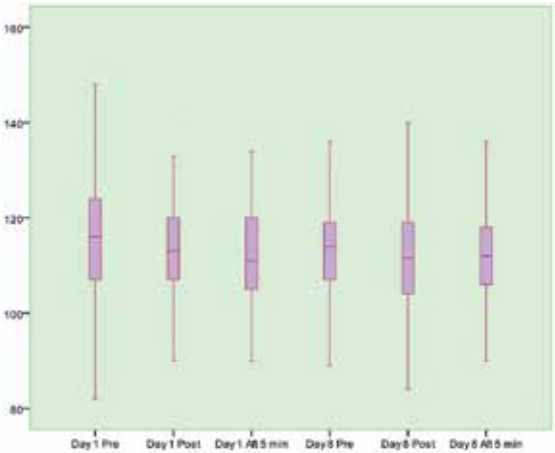
11 post-graduate students of Applied Yogic Science at Bihar Yoga Bharati, Munger, were given an experimental assignment to study the physiological effects of sheetali pranayama. Yoga Research Foundation (YRF) guided them in the experiment. Each student experimented on 5 of

their fellow students. They were young healthy adults of both genders and between 20 to 35 years of age. These 54 subjects were taught sheetali pranayama and were allowed to practise sufficiently. After about a week they were invited to the YRF laboratory. All the parameters of pre data were collected. They were guided into a relaxed, focused state and then into the practice of 15 rounds of sheetali pranayama. At the end they were guided to externalize their awareness. Immediately after the practice and 5 minutes later data was collected. The subjects came daily at a fixed time for their sheetali pranayama practice for one week. On day 8 all the parameters were collected again the same way as on day 1.

Results

After sheetali pranayama systolic and diastolic BP showed significant decrease. This fall was maintained 5 minutes after the practice also. The pulse-rate and body temperature remained steady. None of the parameters showed any trend over the period of 8 days of regular practice. See Tables 1 and 2 and the accompanying graphs.

Effect of Sheetali Pranayama on Systolic BP



Effect of Sheetali Pranayama on Diastolic BP

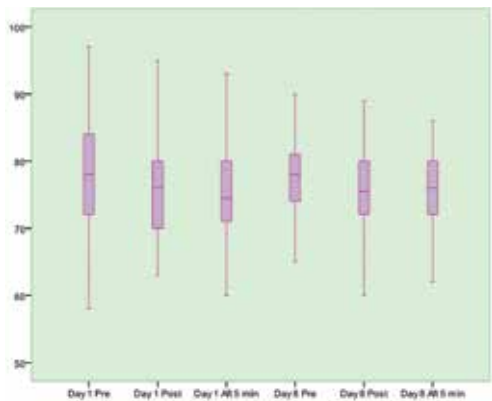


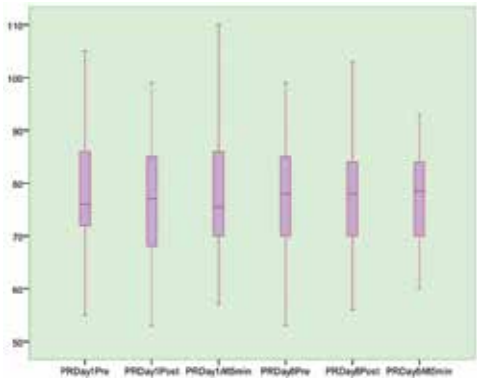
Table 1: Cardiovascular effects of sheetali pranayama

n=54	Day 1				Day 8			
	Mean	Std dev	F	Signifi- cance	Mean	Std dev	F	Signifi- cance
Systolic BP								
Pre	116.57	13.39	5.064	0.010	114.50	11.92	5.975	0.005
Post	113.72	12.30			111.39	12.12		
After 5 mins	113.93	16.57			112.31	9.72		
Diastolic BP								
Pre	78.02	10.73	2.823	0.069	77.30	7.98	5.231	0.009
Post	76.00	7.69			75.35	7.23		
After 5 mins	75.78	6.89			75.89	5.67		
Pulse-rate								
Pre	78.02	12.34	0.524	0.595	77.35	9.97	3.866	0.027
Post	77.00	11.16			78.33	10.29		
After 5 mins	77.22	11.14			76.89	8.88		

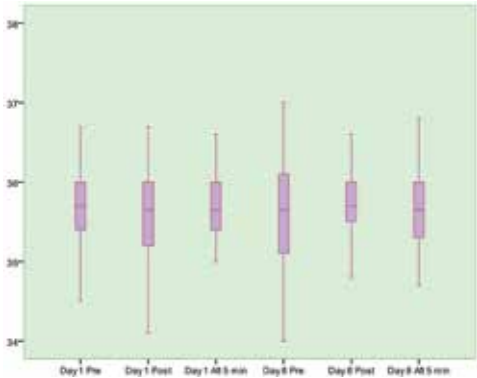
Table 2: Effect of sheetali pranayama on body temperature

n=54	Day 1				Day 8			
	<i>Mean</i>	<i>Std dev</i>	<i>F</i>	<i>Signifi- cance</i>	<i>Mean</i>	<i>Std dev</i>	<i>F</i>	<i>Signifi- cance</i>
<i>Pre</i>	35.68	0.56	0.324	0.725	35.58	0.67	1.199	0.310
<i>Post</i>	35.65	0.52			35.66	0.54		
<i>After 5 mins</i>	35.69	0.42			35.70	0.52		

Effect of Sheetali Pranayama on Pulse Rate



Effect of Sheetali Pranayama on Body Temperature

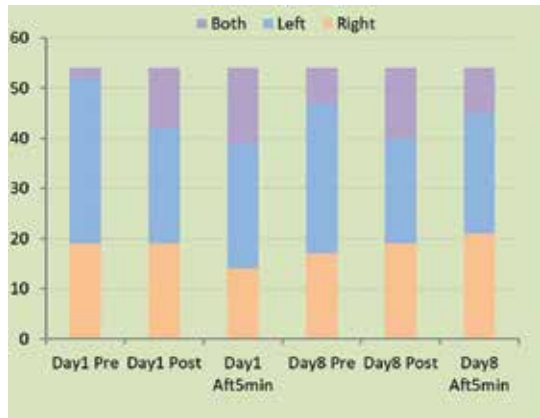


The swara showed change towards breathing through both nostrils which was sustained after the practice. See Table 3 and the accompanying graphs.

Table 3: Frequency table for swara in sheetali pranayama

n=54	Day 1			Day 8		
	Right	Left	Both	Right	Left	Both
Pre	19	33	2	17	30	7
Post	19	23	12	19	21	14
After 5 min	14	25	15	21	25	8

Effect of Sheetali Pranayama on Swara



Conclusion

Sheetali pranayama statistically significantly reduces systolic and diastolic BP in young healthy normotensive individuals. However, this change is not clinically substantial. It does not change the pulse-rate or the body temperature. The flow of swara changed towards a balanced swara in both nostrils.

Moola Bandha, 2004

Introduction

Moola bandha is a practice of hatha yoga. Sri Swami Satyananda describes it as ‘The Master Key’ in the book *Moola Bandha*, authored by Swami Buddhananda and first printed in 1978 in Munger, Bihar. At the physical level it involves contraction of certain muscles in the perineum where mooladhara chakra is situated in the subtle body. It has great implications on our pranic body and our subconscious and unconscious mind. It has the potential to touch upon our samskaras, the impressions which our consciousness has gathered over previous births, and kundalini, the inherent source of primordial energy.

Yoga Research Foundation (YRF) in collaboration with Bihar Yoga Bharati (BYB) conducted a simple research study to observe the basic effects of moola bandha on the body, mind and prana, the energy system,.

Hypotheses

Practice of moola bandha will:

1. Increase systolic and diastolic BP
2. Increase pulse-rate
3. Increase body temperature
4. Induce pingala or right swara dominance
5. Increase energy level
6. Induce subtle effects on the state of mind
7. Induce pranic experience.

Research design

Progressive, Uncontrolled, Pre-Post design and Statistics using SPSS.17 software;

One-way ANOVA / paired sample two-tailed t test statistics were used to establish the hypotheses.

Subjects

63 students of Yogic Studies, 2004, of Bihar Yoga Bharati of both genders and between 18 to 55 years of age served as subjects. Subjects with uncontrolled hypertension or ischemic heart disease were excluded.

Parameters

1. *Systolic and diastolic BP:*
Digital BP instrument; Day 1 & 8 – pre, post & after 5 min
2. *Pulse-rate:*
Digital BP instrument; Day 1 & 8 – pre, post & after 5 min
3. *Body temperature:*
Digital thermometer; Day 1 & 8 – Pre, post & after 5 min
4. *Swara:*
Observation using hand; Day 1 & 8 – Pre, post & after 5 min
5. *Pranic and psychological effects:*
Locally designed questionnaire; Day 1 & 8

Method

The subjects were informed in depth about the research project and the practice of moola bandha. Their consent was obtained in writing. They were taught two stages of the practice of moola bandha: short repeated contractions and sustained single contraction. The ‘pre’ readings of all the parameters were collected on day 1.

The subjects then performed seven rapid contractions of moola bandha then took a deep breath in and performed sustained contraction as long as the breath could be held in. Just before exhalation moola bandha was released. This made one round of moola bandha. After 3 to 5 natural breaths the practice was repeated for a total of five times. The ‘post’ readings of the relevant parameters were collected, and ‘after 5 minutes’ yet another set of data was collected. The participants practised daily moola bandha under supervision of the researcher at a fixed time. On day 8, the last day of the study, the whole set of ‘pre, post and after 5 minutes’ data were collected.

Results

Moola bandha is said to be a stimulating practice that can reduce *tamas* or sluggishness and lead to a surge in energy. At the physical level it can stimulate CV system and metabolism leading to a temporary rise in systolic and diastolic BP and pulse-rate and an increase in body temperature. In this study we did not find such an effect either immediately after the practice or over the period of the study. See Tables 1 to 4.

Table 1: Effect of moola bandha on systolic BP: ANOVA

n=63		Mean	Std dev	F	Significance
Day 1	Pre	104.25	10.52	0.159	0.853
	Post	104.37	10.96		
	After 5 min	103.37	11.24		
Day 8	Pre	105.71	9.84	0.787	0.457
	Post	106.90	13.91		
	After 5 min	104.43	8.84		

Table 2: Effect of moola bandha on diastolic BP: ANOVA

n=63		Mean	Std dev	F	Significance
Day 1	Pre	69.05	8.81	0.272	0.762
	Post	67.92	8.74		
	After 5 min	68.25	8.87		
Day 8	Pre	69.38	7.81	0.005	0.995
	Post	69.33	7.98		
	After 5 min	69.24	8.56		

Table 3: Effect of moola bandha on pulse-rate: ANOVA

n=63		Mean	Std dev	F	Significance
<i>Day 1</i>	<i>Pre</i>	71.67	10.93	0.090	0.914
	<i>Post</i>	71.90	10.59		
	<i>After 5 min</i>	71.13	10.05		
<i>Day 8</i>	<i>Pre</i>	70.75	7.00	0.183	0.833
	<i>Post</i>	70.92	6.86		
	<i>After 5 min</i>	71.46	6.89		

Table 4: Effect of moola bandha on body temperature: ANOVA

n=63		Mean	Std dev	F	Significance
<i>Day 1</i>	<i>Pre</i>	35.98	0.48	0.894	0.411
	<i>Post</i>	36.00	0.46		
	<i>After 5 min</i>	35.89	0.55		
<i>Day 8</i>	<i>Pre</i>	35.88	0.50	0.068	0.934
	<i>Post</i>	35.91	0.56		
	<i>After 5 min</i>	35.90	0.49		

Swara or the dominance of nostril flow can be checked by placing one's hand or a mirror under the nose and checking which of the two nostrils is allowing greater air flow at the time of exhalation. The science of swara yoga says that right nostril dominance or pingala nadi activation stimulates body-mind-prana while left nostril dominance or ida nadi activation calms it down. When both nostrils are flowing equally then there is balance at all levels.

The study of swara showed an initial internalizing and balancing effect, left or both nostril dominance, followed

by release of prana shakti (energizing effect), right nostril dominance. The effects were more pronounced on day 8 as the subjects became more proficient in the practice. The overall changes were not of great magnitude.

Table 5: Effect of moola bandha on swara: frequency table

n=63		Swara
Day 1	Pre	25R, 20L, 18B
	Post	24R, 23L, 16B
	After 5 min	26R, 20L, 17B
Day 8	Pre	23R, 25L, 15B
	Post	17R, 26L, 20B
	After 5 min	26R, 27L, 10B

The subtle pranic and psychological effects were studied by using a questionnaire. The six dimensions measured were:

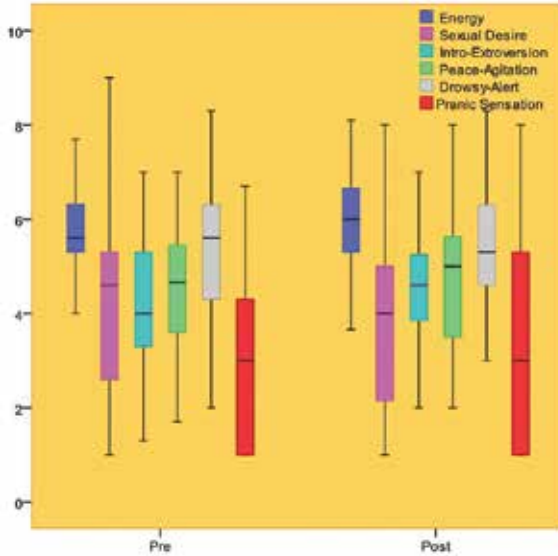
1. Energy level
2. Sexual desire
3. Level of introversion–extroversion
4. Level of peace-agitation
5. Level of drowsiness–alertness
6. Pranic sensations

Each dimension was measured on a scale of 1 to 10. Low score indicated low energy, minimum sexual desire, introversion, peace, drowsiness and minimum pranic sensations. High score indicated just the reverse, dynamic energy, intense sexual desire, extroversion, agitation, alertness and intense pranic experience. There was statistically significant decrease in sexual desire (0.054) and increase in pranic experience (0.007) at mooladhara and swadhisthana chakras on day 8. There was less significant but substantial increase in energy level (0.076) and extroversion (0.186). There was minimal increase in agitation of mind and alertness. See Table 6 and the accompanying graph.

Table 6: Subtle effects of moola bandha

n=63		Mean	Std dev	T value	Significance	25 percentile	50 percentile	75 percentile
<i>Energy</i>	<i>Day 1</i>	5.79	1.10	1.807	0.076	5.3	5.6	6.33
	<i>Day 8</i>	6.05	1.32			5.3	6.0	6.7
<i>Sexual desire</i>	<i>Day 1</i>	4.03	1.82	1.961	0.054	2.6	4.6	5.3
	<i>Day 8</i>	3.76	1.92			2.0	4.0	5.0
<i>Intro-extro</i>	<i>Day 1</i>	4.22	1.35	1.336	0.186	3.3	4.0	5.3
	<i>Day 8</i>	4.44	1.42			3.7	4.6	5.3
<i>Peace-agitation</i>	<i>Day 1</i>	4.46	1.42	1.142	0.258	3.6	4.66	5.6
	<i>Day 8</i>	4.63	1.33			3.3	5.0	5.66
<i>Drowsy-alert</i>	<i>Day 1</i>	5.36	1.48	0.414	0.680	4.3	5.6	6.3
	<i>Day 8</i>	5.44	1.42			4.6	5.3	6.3
<i>Pranic sensation</i>	<i>Day 1</i>	2.97	1.84	2.815	0.007	1.0	3.0	4.3
	<i>Day 8</i>	3.32	2.18			1.0	3.0	5.3

Subtle Effects of Moola Bandha



Conclusion

The physical dimensions of stimulation could not be proved. The swara pattern was indicative but not conclusive of stimulation of pingala nadi. Pranic and psychological dimensions also were indicative of stimulation.

Inconclusive Research

III: Research on
Application of Yoga

Yoga and Puberty, 2004–2009

Summary

Reviving the concept of *upanayana samskara*, the Indian sacred thread ritual, research was conducted on the effect of Satyananda Yoga practices at the onset of puberty in pre-adolescent children. Thirty-four children of class IV, between 8 and 9 years of age, practised daily the Gayatri mantra, surya namaskara and nadi shodhana pranayama with gentle shambhavi mudra. The practices were done throughout the academic year for the first three years and then twice a week for the following two years.

No delay in the onset of puberty or any changes in rational intelligence, academic performance or psychological disposition such as sexuality, aggression, hostility, fear, insecurity or distorted body image were found.

Introduction

Sri Swami Satyananda Saraswati revived the ancient vedic tradition of upanayana samskara maintaining its essence, while giving it a more practical and yogic format. He said that every girl and boy after the age of eight years should practise regularly surya namaskara, nadi shodhana pranayama with shambhavi mudra and the chanting of Gayatri mantra. He claimed that after the age of eight the function of the pineal gland in the brain starts to die and the pituitary gland takes over the role of the master endocrine gland. This gradual process ultimately sets the scene for the onset of puberty.

The maturing pituitary starts the secretion of gonad stimulating hormones in both genders. The gonads in turn secrete the sex hormones which are responsible for the physical and the psychological changes of puberty. The practices of surya namaskara, nadi shodhana pranayama with shambhavi mudra and the chanting of Gayatri mantra

keep the pineal gland active for a little while longer and thus delay the sexual changes in the body as well as the mental traits such as interest in the opposite gender, aggression, hostility, fear and insecurity.

Acknowledgement

The study was conducted in collaboration with Satyananda Yoga Kendra, Indore, MP, India, in cooperation with the management of Madhav Vidyapeeth and Lokmanya School of Indore.

Hypotheses

In comparison to the control group, regular practice of surya namaskara, nadi shodhana pranayama with shambhavi mudra and the chanting of Gayatri mantra for five years will:

1. Delay the onset of puberty by six months;
2. Increase height by two centimetres;
3. Increase body weight towards the optimum by two kg;
4. Increase the breadth of shoulders by one centimetre;
5. Change the waist to hip girth ratio towards optimum;
6. Reduce absenteeism due to health reasons;
7. Increase rational intelligence;
8. Improve academic performance;
9. Induce a balanced and positive psychological disposition.

Parameters

1. *Onset of puberty:*

• Sudden acceleration in growth	Height scale	6 mthly
• Onset of hair growth in axilla	Observation	6 mthly
• Onset of menstruation in girls	Enquiry	6 mthly
• Development of breast in girls	Observation	6 mthly
• Onset of growth of moustache in boys	Observation	6 mthly
• Change in voice in boys	Observation	6 mthly

2. *Physical growth:*

• Height	Height scale	6 mthly
• Weight	Weighing scale	6 mthly
• Abdominal girth at naval	Measuring tape	6 mthly
• Hip circumference at mid-inguinal point	Measuring tape	6 mthly
• Shoulder breadth	Measuring tape	6 mthly

3. *Health:*

• Absence in school due to sickness	Attendance register	Yearly
-------------------------------------	---------------------	--------

4. *Rational intelligence:*

• Rational intelligence	Raven's Coloured/Standard Progressive Matrices	Yearly
-------------------------	--	--------

5. *Scholastic performance:*

• Scholastic performance	Academic performance in school	Yearly
--------------------------	--------------------------------	--------

6. *Sexual and hormone-influenced mental traits:*

• Sexual and hormone-influenced mental traits	Somatic Inkblot Series (SIS) Test	Yearly
---	-----------------------------------	--------

Research method

Progressive controlled repeated measures trial; F statistics using SPSS 17 software was used to prove the hypotheses.

Subjects

Class IV children of Madhav Vidyapeeth School and children between 8 and 9 years of age from Lokmanya School of Indore city formed the research group.

Exclusion criteria

Children who did not continue in the same school and same class for five years.

Method

The participating children of the two schools were randomly allocated to either the yoga group or the control group. Parental consent to participate in the study was obtained. The children were requested to fill in a basic biodata questionnaire. The pre data was collected. The yoga group practised surya namaskara, nadi shodhana pranayama and Gayatri mantra five times a week for the first three academic years and twice a week in the fourth and fifth years during their school time.

They were observed for signs of the onset of puberty: spurt in growth, onset of menstruation, development of breasts, axillary hair growth, deepening of voice and development of moustache, height, weight, abdominal/waist and hip girths, breadth of shoulders, physical growth, rational intelligence and academic performance. For puberty-induced psychological traits they were observed for fear, insecurity, hostility, aggression and distorted body image.

The control group practised a set of physical exercises and organized outdoor games and prayers. The data were regularly collected from both groups every six months/yearly as per the schedule. The intervention continued for five consecutive years. Students who changed school or were detained were automatically excluded from the study.

Results

At the beginning 92 children were enrolled. 59 children, 34 in the yoga group and 25 in the control group could complete the study. There were 22 girls and 37 boys. See Table 1. Children of Lokmanya School were from a low socio-economic class and those of Madhav Vidyapeeth were from a middle socio-economic class. See Table 2.

Table 1: Demographic characteristics of the sample

Y: n=34 C: n=25	Madhav		Lokmanya	
	<i>Yoga</i>	<i>Control</i>	<i>Yoga</i>	<i>Control</i>
<i>n</i>	14	11	20	14
<i>Girls</i>	3	4	9	6
<i>Boys</i>	11	7	11	8
<i>Age (mth)</i>	107.71	107.64	103.45	102.21

Table 2: Socio-economic characteristics of the sample

Y: n=34 C: n=25	Madhav		Lokmanya	
	<i>Yoga</i>	<i>Control</i>	<i>Yoga</i>	<i>Control</i>
<i>n</i>	14	11	20	14
<i>Middle</i>	14	11	0	0
<i>Lower</i>	0	0	20	14

Table 3: Diet habit of the sample

Y: n=34 C: n=25	Madhav		Lokmanya	
	<i>Yoga</i>	<i>Control</i>	<i>Yoga</i>	<i>Control</i>
<i>Vegetarian</i>	11	10	9	8
<i>Non-vegetarian</i>	3	1	11	6

As a child enters puberty hormone-induced changes take place in the body as well as in his/her psychological disposition. In a female child menstruation begins, breasts start developing and the hips widen. In a male child facial hair starts growing, shoulders widen and the voice deepens. In both genders there is a sudden increase in height and hair starts growing in the armpits and the groin. No delay in the onset of puberty in the yoga group was found. See Table 4.

Table 4: Effect of yoga on the age (in months) of onset of puberty: mean values

YF: n=12 YM: n=22	CF: n=10 CM: n=15	Yoga		Control	
		Female	Male	Female	Male
Menarche	Mean	143.70	na	154.33	na
	Minimum	123.00	na	150.00	na
	Maximum	160.00	na	160.00	na
Breast/ moustache	Mean	140.58	159.10	153.57	160.11
	Minimum	120.00	146.00	143.00	145.00
	Maximum	158.00	178.00	171.00	175.00
Spurt in height	Mean	127.58	147.27	139.63	144.60
	Minimum	105.00	134.00	130.00	128.00
	Maximum	144.00	165.00	153.00	162.00
Hair in axilla	Mean	163.67	163.33	160.00	165.00
	Minimum	156.00	161.00	144.00	154.00
	Maximum	174.00	168.00	172.00	173.00
Deep voice	Mean	na	170.00	na	169.80
	Minimum	na	164.00	na	160.00
	Maximum	na	178.00	na	179.00

The effect of Satyananda Yoga practices on the physical growth of children was measured by monitoring their height, weight, girth at waist and hip and breadth of shoulders every six months. No difference in the pattern of physical growth was observed between the yoga group and the control group. See Tables 5 and 5a.

Table 5: Effect of yoga on physical growth: mean values

	Group	Jul 04	Jan 05	Jul 05	Jan 06	Jul 06	Jan 07	July 07	Jan 08	Jul 08	Jan 09	Jul 09
<i>Height</i>	<i>Yoga</i>	127.21	130.08	132.67	134.71	137.58	139.92	143.50	147.25	149.92	152.83	154.83
	<i>Control</i>	123.80	127.15	129.60	131.30	134.40	136.45	139.70	143.65	147.30	150.45	152.25
<i>Weight</i>	<i>Yoga</i>	22.38	24.42	25.05	26.82	28.08	29.97	31.41	33.54	35.53	37.68	40.00
	<i>Control</i>	21.20	23.02	23.90	25.21	26.13	28.08	29.86	32.37	34.26	36.58	38.52
<i>Waist</i>	<i>Yoga</i>	56.16	53.21	51.95	52.58	53.26	56.42	55.90	58.32	59.42	61.68	62.47
	<i>Control</i>	55.47	52.74	53.26	52.90	53.79	55.90	56.68	58.42	60.16	61.95	62.95
<i>Hip</i>	<i>Yoga</i>	63.00	63.42	63.00	65.26	67.26	69.37	70.58	72.26	75.21	74.03	78.53
	<i>Control</i>	62.53	61.74	63.32	64.11	66.16	68.84	69.79	71.84	75.16	75.37	78.79
<i>Shoulder</i>	<i>Yoga</i>	33.00	33.42	33.15	33.90	34.00	35.00	36.00	38.42	37.00	37.95	37.68
	<i>Control</i>	31.00	31.63	32.58	32.63	32.42	33.37	34.95	36.63	35.47	36.16	36.47

Table 5a: Effect of yoga on physical growth: statistical values

	F	Significance	Partial eta squared	Observed power
Height	1.712	0.119	0.342	0.694
Weight	0.664	0.747	0.197	0.264
Waist	0.936	0.517	0.257	0.375
Hip	1.249	0.307	0.316	0.501
Shoulder	1.188	0.341	0.306	0.477

One of the common reasons for absenteeism in schools is ill-health. School attendance is a mirror that indirectly reflects the physical health of the students. No significant difference was found between the attendances of the two groups over the five-year period. See Table 6 and 6A.

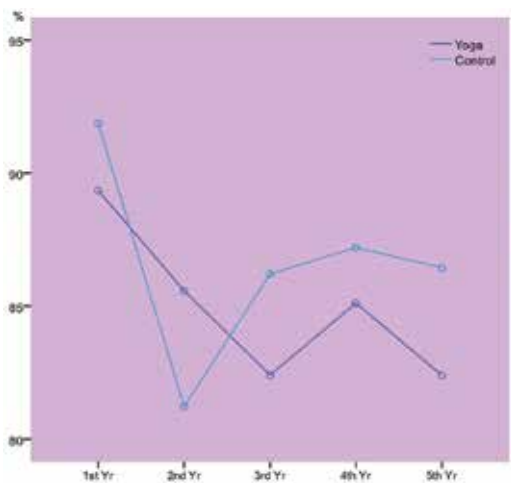
Table 6: Effect of yoga on school attendance (%): mean values

	2004-05	2005-06	2006-07	2007-08	2008-09
Yoga	89.35	85.58	82.41	85.12	82.40
Control	91.87	81.23	86.20	87.20	86.44

Table 6a: Effect of yoga on school attendance (%): statistical values

	F	Significance	Partial eta squared	Observed power
Attendance	1.181	0.331	0.088	0.343

Effect of Yoga on Health – School Attendance



Rational or logical thinking is an important asset for success in any undertaking. Raven’s Coloured Matrices and Standard Matrices constitute a progressive test to measure rational thinking beyond the cultural or language barriers. The intellectual growth of children was measured yearly for the duration of the study using Raven’s Progressive Matrices. The results are expressed in terms of grades 1 to 9, grade 1 is the highest, grade 5 is average and grade 9 is the lowest. The yoga group showed greater improvement in intellectual growth but statistically the difference was not significant. See Tables 7 and 7a and the accompanying graphs.

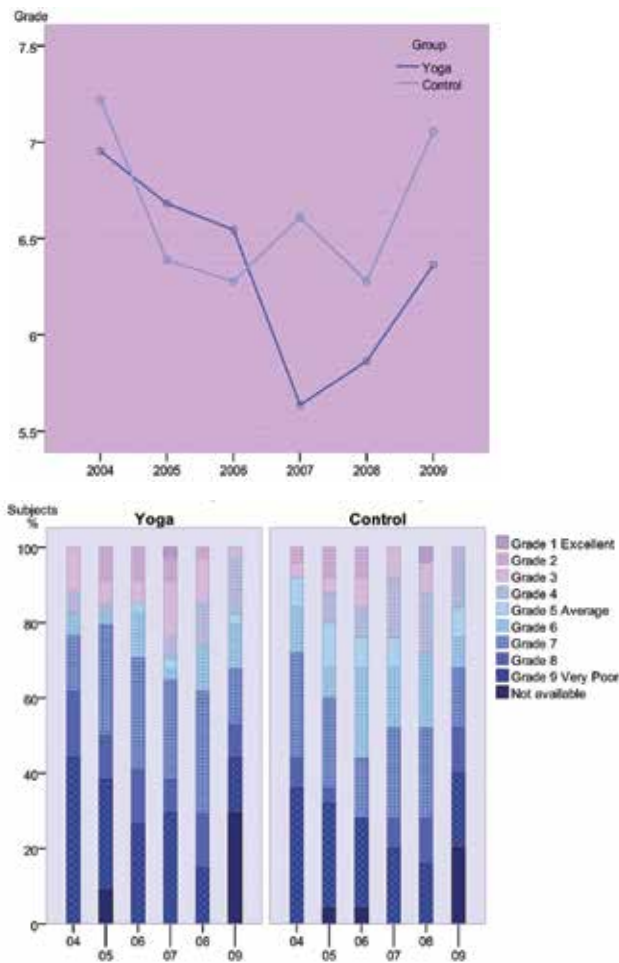
Table 7: Effect of yoga on rational intelligence: mean values

	Rational Intelligence (grade)					
	2004	2005	2006	2007	2008	2009
Yoga	6.95	6.68	6.55	5.64	5.86	6.36
Control	7.22	6.39	6.28	6.61	6.28	7.06

Table 7a: Effect of yoga on rational intelligence: statistical values

	F	Significance	Partial eta squared	Observed power
<i>Rational intelligence</i>	0.882	0.504	0.115	0.276

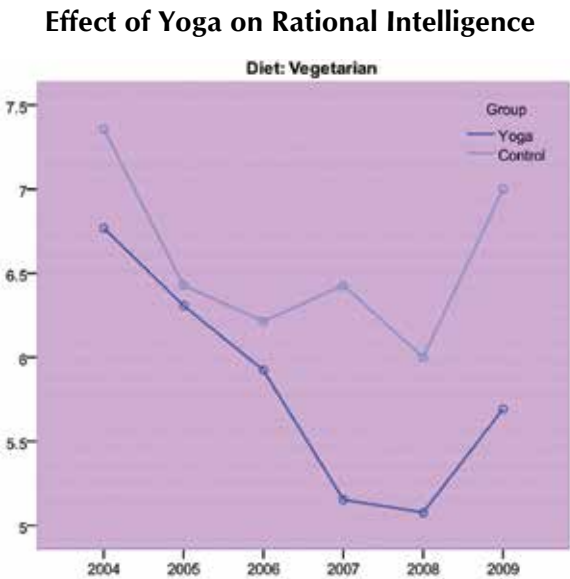
Effect of Yoga on Rational Intelligence



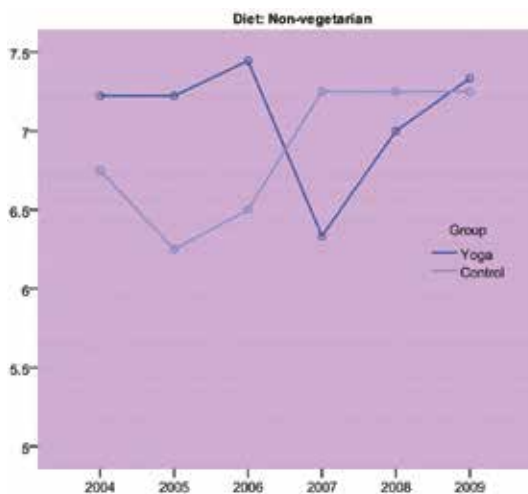
For children who were vegetarians yoga had a greater effect on rational intelligence although it was not statistically significant. See Table 8 and the accompanying graphs.

Table 8: Effect of yoga and diet on rational intelligence: mean values

		2004	2005	2006	2007	2008	2009
Vegetarian	Yoga	6.769	6.308	5.923	5.154	5.077	5.692
	Control	7.357	6.429	6.214	6.429	6.000	7.000
Non-vegetarian	Yoga	7.222	7.222	7.444	6.333	7.000	7.333
	Control	6.750	6.250	6.500	7.250	7.250	7.250



Effect of Yoga on Rational Intelligence



The second area of intellectual growth was measured with scholastic performance in the school's annual examination. No difference in academic performance was observed during the five-year research. See Tables 9 and 9a.

Table 9a: Effect of yoga on academic performance: statistical values

	F	Significance	Partial eta squared	Observed power
<i>English</i>	0.910	0.482	0.080	0.299
<i>Math</i>	2.387	0.050	0.187	0.714
<i>Hindi</i>	0.259	0.933	0.024	0.108
<i>Environmental Sc.</i>	0.802	0.534	0.103	0.224
<i>Sanskrit</i>	5.408	0.010	0.272	0.804
<i>Science</i>	0.930	0.406	0.060	0.195
<i>Social Science</i>	1.155	0.329	0.074	0.234

Table 9: Effect of yoga on academic performance: mean values

	Yoga						Control					
	2004	2005	2006	2007	2008	2009	2004	2005	2006	2007	2008	2009
<i>English</i>	62.21	43.35	54.56	55.47	54.41	50.15	60.17	41.92	57.67	57.54	58.50	55.42
<i>Math</i>	67.03	63.00	60.41	51.91	48.332	48.38	62.92	64.42	62.58	51.54	52.54	54.54
<i>Hindi</i>	66.56	56.65	60.71	59.53	54.97	65.35	66.88	54.08	61.92	59.67	53.63	64.50
<i>Env. Sc.</i>	59.00	62.60	45.80	53.20	53.55	na	59.46	65.46	50.69	50.62	55.31	na
<i>Sanskrit</i>	na	na	na	62.95	56.60	54.70	na	na	na	71.83	64.75	55.83
<i>Science</i>	na	na	na	51.50	50.00	45.90	na	na	na	52.67	53.17	52.08
<i>Soc. Sc.</i>	na	na	na	61.05	46.15	55.90	na	na	na	70.33	45.67	57.17

The surge in sexual hormones has a profound influence on thoughts, emotions and behaviour of adolescents undergoing pubertal changes. Interest in the opposite gender, distorted body image or undue focus on the body, a sense of insecurity, fear of a wide range of issues, hostility and aggression are commonly observed in this age group.

SIS, Somatic Inkblot Series, is a projective psychological test which was used to monitor the psychological disposition of the subjects. There was no statistically significant difference between the two groups though the yoga group showed less fear, insecurity, hostility and aggression. See Tables 10 and 10a and the accompanying graph.

Table 10: Effect of yoga on psycho-disposition in children: mean values

	Yoga					
	2004	2005	2006	2007	2008	2009
<i>Sexuality</i>	0.04	0.75	1.83	0.29	1.83	0.50
<i>FI*</i>	0.87	4.92	3.67	3.25	4.96	6.42
<i>DBI@</i>	0.58	1.29	0.63	0.67	1.25	1.71
<i>HA#</i>	0.29	3.63	3.04	2.58	3.71	4.71

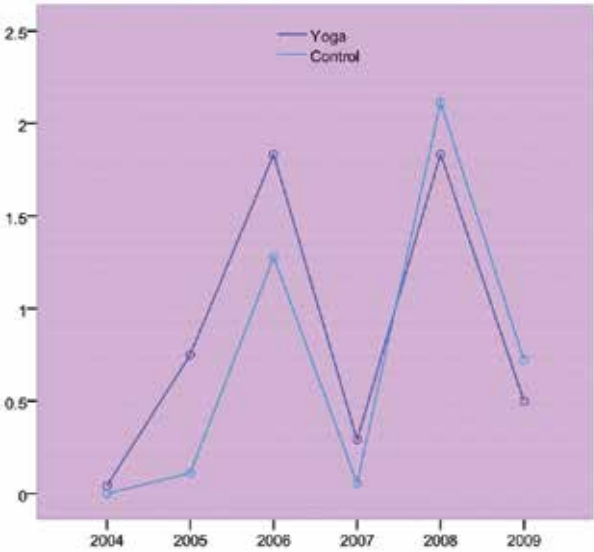
	Control					
	2004	2005	2006	2007	2008	2009
<i>Sexuality</i>	0.00	0.11	1.28	0.06	2.11	0.72
<i>FI*</i>	1.50	5.22	5.22	4.44	5.89	6.00
<i>DBI@</i>	0.22	0.78	1.44	1.17	1.11	1.11
<i>HA#</i>	1.28	4.44	3.78	3.17	4.78	4.89

FI* = Fear & insecurity
 DBI@ = Distorted body image
 HA# = Hostility & aggression
 The lower readings indicate better results

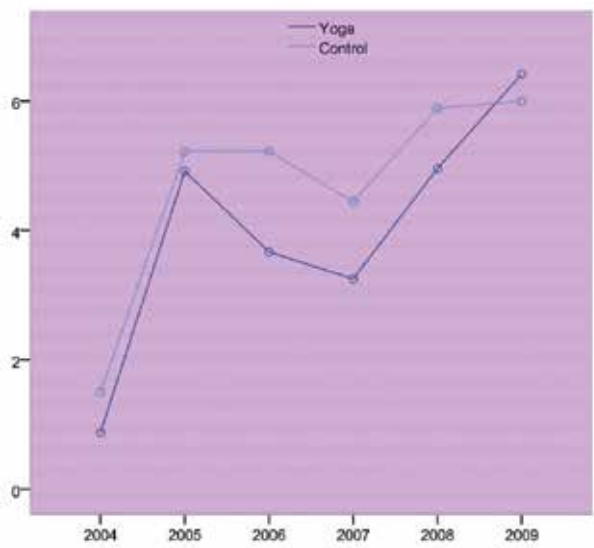
Table 10a: Effect of yoga on psycho-disposition in children: statistical values

	F	Significance	Partial eta squared	Observed power
<i>Sexuality</i>	1.852	0.127	0.205	0.563
<i>FI*</i>	0.749	0.592	0.094	0.238
<i>DBI@</i>	1.380	0.255	0.161	0.429
<i>HA#</i>	0.309	0.904	0.041	0.117

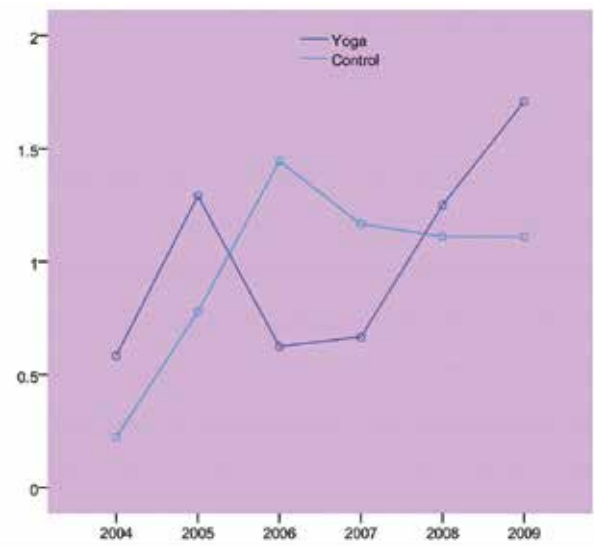
Effect of Yoga on Psychodisposition – Sexuality



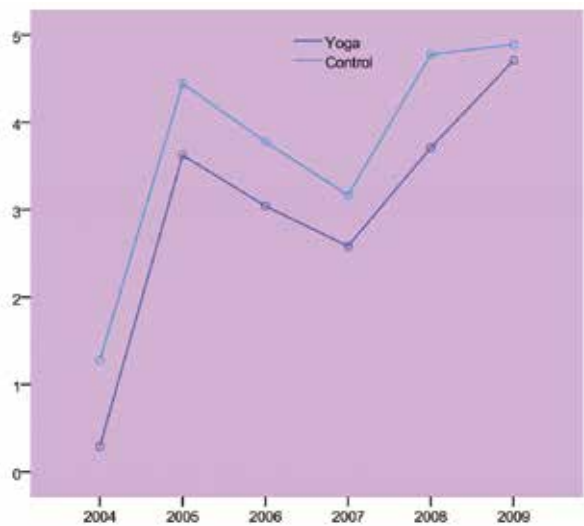
Effect of Yoga on Psychodisposition – Fear & Insecurity



Effect of Yoga on Psychodisposition – Distorted Body Image



Effect of Yoga on Psychodisposition – Hostility & Aggression



Conclusion

At the onset of puberty the regular practice of Satyananda Yoga by pre-adolescent children for five academic years did not show any difference between the yoga group and the control group, nor were there any differences in growth, physical, intellectual or psychological maturity and balance.

This could be attributed to the fact that teachers frequently changed and could not generate interest for yoga in the children. The new teachers were not able to motivate the children who therefore only practised half-heartedly. The control group was having fun playing games. The children of the yoga group felt left out and their hearts were not in practising yoga.

Pre-examination Anxiety and Memory in Adolescent Students, 2008–2009

Summary

80 students of class IX of BHEL-run Jawaharlal Nehru School, Bhopal, India, were given a 30 minutes yoga class three times a week for the whole academic year. Their anxiety level and memory power were tested using STAI questionnaire and PGI memory test respectively before their annual examinations of class VIII and class IX. The results show no change in anxiety level and some improvement in memory power. Their annual score in Science, English and Math show a decrease by 10%, 10% and 7% respectively.

Introduction

It is a well-proven fact that yoga is an effective tool to relieve stress and stress-generated anxiety. Yoga achieves it through many paths. By sharpening the individual's faculty of awareness yoga helps to identify the situation of stress and then the external and internal causes leading to stress. Yoga provides the tools with which one can disseminate the physiological response to stress in the body. Yoga also helps to develop necessary traits, such as empathy, cooperation, patience, absence of jealousy in one's character that will minimize the incidence of stress in day-to-day life. It will also help develop or strengthen the necessary attitudes, such as 'forgive and forget', and learning through failure, to minimize the long-term aftereffects of stress on the psyche.

It is also a well-known fact that when under stress or anxious one is not able to recollect well what has been learnt previously, in other words, memory fails. The ability to relax at will, to deal with stress effectively and release pent-up anxiety consciously with the help of yoga enables one to maintain memory power. The ability to concentrate on a given task with minimum distractions and expanding the

attention span with the help of yoga improves one's memory power. Yoga is thus an efficient means to combat poor anxiety-induced performance in examination of any kind, such as written tests and interviews. We tried to prove this phenomenon objectively by conducting the following experiment.

Hypotheses

Regular practice of yoga for at least six months will:

- Decrease anxiety level
- Improve memory

Research design

Progressive Uncontrolled Pre-Post design; student's t test statistics and multi-variate F statistics were used to conclude the hypotheses.

Research method

Selection criteria: All students of class IX of a higher secondary school run by the industrial community of BHEL, Bhopal.

Exclusion criteria: Irregular attendance in the yoga class or incomplete data.

Experiment

All students of class VIII (96) of Jawaharlal Nehru High School, BHEL, Bhopal, were tested for their anxiety using STAI questionnaire and for memory power using PGI Memory Scale 3 to 5 days before their annual examination. When they entered class IX they were given a yoga class of 30 minutes three times a week throughout the academic year from July 2008 to February 2009. They were trained in different asanas, pranayamas, mantra and yoga nidra.

They were encouraged to observe truthfulness and practise self-observation. They were also requested to practise yoga at home when they did not have a class. At the end of one academic year, 3–5 days prior to the annual examination they were again tested for anxiety level and memory power using the same tests. Their academic

performance in the annual examination in class VIII and class IX were also recorded.

Results

80 out of 96 students fulfilled the selection criteria. There were 10 girl students and 71 boys. Their mean age as on 31 May 2008 was 167.69 months or 14 years, and the age range was between 155-183 months or 12 years 11 months to 15 years 3 months.

As shown in Table 1 and graphs 1 and 3, there was no change in the anxiety level but there was a small improvement in memory by 2.28. Academically the performance deteriorated in all the three subjects.

It is interesting to note that in the control group of 47 students of class VII and VIII, mean age 13.33 years, of another BHEL-run school, Dr Radhakrishnan School, anxiety and memory tests done under similar conditions but without the intervention of yoga practices show to some extent decrease in anxiety level, reduction in memory power and improvement in marks obtained in all the three subjects. See Table 1 and graphs 2 and 3 for details. There is a significant difference between the yoga and the control groups as shown in Table 2.

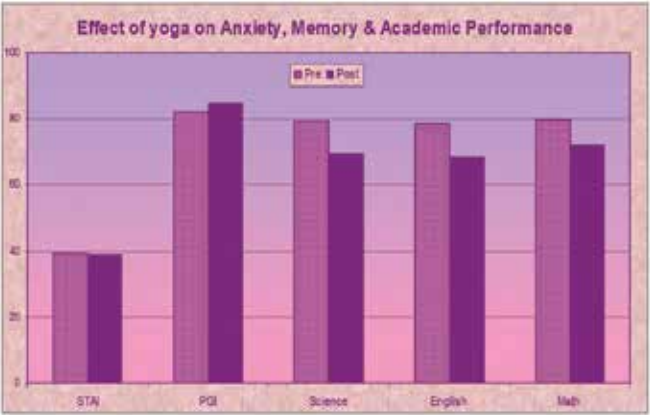
Table 1: Effect on anxiety, memory and academic result

	Yoga n=80		Control n=47	
	Pre	Post	Pre	Post
<i>STAI score</i>	39.30	39.19	44.81	41.45**
<i>PGI memory</i>	82.26	84.54	80.16	78.98
<i>Science</i>	79.28	69.08*	62.09	65.09
<i>Math</i>	79.74	71.86*	56.55	59.15
<i>English</i>	78.60	68.29*	58.40	59.40

*Significant at 0.001

**Significant at 0.005

Graph 1



Graph 2

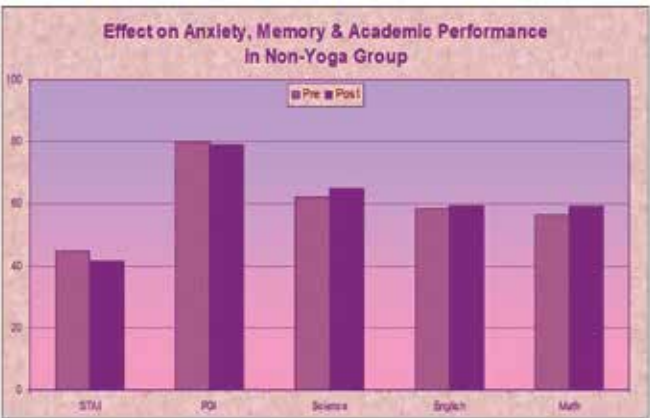
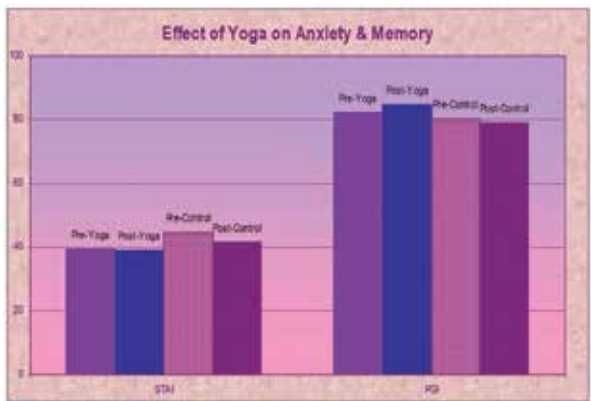


Table 2: Multi-variate Test of Significance in BHEL school children

Y: n=80 C: n=47	F	Significance	Partial eta squared	Observed power
STAI (anxiety)	5.420	0.022	0.042	0.637
PGI (memory)	2.307	0.131	0.018	0.326
Science	27.516	0.000	0.180	0.999
Math	11.062	0.001	0.081	0.910
English	27.058	0.000	0.178	0.999

Graph 3



Discussion

The syllabus of this study included asanas, pranayama, yoga nidra and mantra chanting. Asanas help to release physical tension. The balancing asanas demand one-pointed awareness and hence improve memory. Breath and pranayama can be used to find control over the state of the mind. Pranayama makes the mind calm, still and focused; distractions are minimized. Yoga nidra is the most powerful tool to relax and release any type of tensions or suppressions

at will. Mantra also releases inner tensions effortlessly and enhances faith and self-confidence. As the mind relaxes and becomes calm, the distraction created by useless fleeting thoughts automatically is minimized. The thought pattern that produces anxiety is removed. The relaxed mind is able to focus on a useful matter effectively. The result is better grasp of the subject, better retention of the subject and improved reproduction when needed. The overall performance of memory function improves.

The result of the anxiety test found in this experiment is totally unexpected and not in alignment with the results found in many other related researches as well as the experience of millions of yoga practitioners. Yoga is a tool where the individual's sincerity and effort are necessary. If an individual is not motivated, not inspired or not interested he will perform yoga practices mechanically or only pretend to do. In such a case he will reap no benefit. This could be the possible reason for the unexpected result.

In spite of no change in anxiety, some improvement in memory is observed. It is not statistically significant and improvement due to practice effect or familiarity cannot be ruled out.

The deterioration in academic performance can be attributed to purposeful strict marking standards in class IX annual examination to push the students to work harder in class X. This is a usual practice in schools.

Conclusion

The hypotheses that regular yoga practice for six months will reduce examination induced stress level and improve memory power could not be proved.

Lack of interest in yoga amongst the subjects and incomplete coverage of the syllabus could be possible reasons for the unexpected results. The experiment needs to be repeated after rectifying these causes before any conclusion is drawn against the efficacy of yoga in relieving anxiety and improving memory.

Kirtan

THE QUICKEST, SAFEST, CHEAPEST, SUREST AND BEST WAY

The mind is a peculiar combination of various kinds of moods, temperaments, whims and fancies. It is a strange mixture of various sentiments and emotions. Therefore, the rishis of yore designed methods to control the mind. Control of the mind forms the most important and major item of spiritual sadhana on the path of God-realization.

Vedanta and jnana can only be understood by a microscopic minority. The vast majority are fit for sankirtan bhakti only. Even the majority of highly intellectual people derive immense benefit by doing sankirtan. Their minds are elevated for practising meditation. Even so, one has to work hard in the practice of kirtan if one wishes to realize fully the fruits of kirtan bhakti yoga.

There is infinite shakti in God's names. It removes impurities from the mind. Vedantins say that there are three kinds of obstacles to Self-realization: impurity, restlessness and ignorance. To remove them they prescribe selfless service, worship and meditation. Sankirtan alone can achieve these three together. Kirtan removes the impurities of the mind, steadies it and checks its tendency to vacillate, and ultimately it tears the veil of ignorance and brings the sadhaka face to face with God. Kirtan enables the devotee to realize the Infinite here and now. Kirtan saves one from delusion.

God is a mystery. Mind is a mystery. The world is a mystery. How sankirtan transmutes human nature into divine nature, how it overhauls the old vicious samskaras, how it changes the mental substance, how it transforms or metamorphoses the asuric nature into a pure sattwic nature and how it brings the devotee face to face with God is also a mystery. Science and reason can hardly explain the modus operandi of sankirtan. However, God's Name is the quickest, safest, cheapest, surest and best way to reach God.

—*Swami Sivananda Saraswati*

THE NAME IS LIGHT

I have developed a unique system of kirtan called the Satyananda system or the Munger system. Elsewhere in India there is no system to kirtan; people shout, they do not listen to others nor do they experience an exalted feeling. In the Satyananda system the participants are aware of God's name. The power created by kirtan changes the whole being from the outside, deep down to the inside. There comes a moment when one can transcend one's personality barriers.

Shiva was the archetypal yogi and he is known as Nataraja, Lord of dance. Greater than Shiva was Sri Krishna who lived life just dancing it. Sri Krishna and his flute are inseparable elements. Where there is Krishna, there is a flute, where there is a flute, there is Krishna. The flute is the symbol of nada yoga, the inner flute that one hears in meditation. Sri Krishna spent his whole life in dancing and singing kirtan.

This is one of the easiest forms of yoga by which one cannot only relax and give spontaneously expression to one's higher or divine nature, one can also be at one with the cosmic self. This yoga brings one nearer and nearer to softness, to the loveliness and the natural feeling of life. Chaitanya, the great kirtanist of the middle ages in India who was born in Bengal, used to sing:

*Sri Krishna Chaitanya, Prabhu Nityananda
Hare Ram, Hare Krishna, Sri Radhe Govinda.*

People used to walk behind him from kirtan to kirtan because this is how one evolves. This is the rhythm, the creativity. This is how one relaxes and increases one's potentiality. Maybe if people doing kirtan were measured they would have high alpha wave pattern vibrations. And what else does one need?

When the name of God is sung in the home it becomes purified. The filth is removed and people remain in a good mental state. When the light of the sun appears, darkness disappears. The name of God is like light. It enlightens and purifies wherever it exists.

Music has so much power that it can free your ego. Through kirtan you can reach the highest pinnacle of spiritual experience. Not by yoga or by any other means but by kirtan alone can you have the vision of the Divine.

—*Swami Satyananda Saraswati*

THE YOGA FOR YOUR FEELINGS

It has been said that kirtan is the way in Kali Yuga. Kirtan is meditation; kirtan is not a wild dance. Kirtan is a meditative process. The purpose of kirtan is to awaken the aspect of memory which remembers one's true Self. It is to awaken that aspect of memory which connects one with the vibration, peace and joy within. Therefore, it becomes a powerful tool when one allows kirtan to come alive within. When the movements follow the vibrations of the kirtan, then kirtan is meditation. In that meditation, there can be fun also, yet it is not a wild fun. It is internal fun which one experiences within oneself.

Kirtan is the chanting of the names of the Self of which one is a part, an expression. While the names composed in Sanskrit may appear to indicate a manifest form of divinity, in which, for example, *Rama* may evoke the image of Sri

Rama and similarly for Sri Krishna, Buddha and Christ, the mantras do not represent a personalized identity of the divinity, but an expression of that force and energy. When one chants the names, it is the syllables that alter the patterns of the mind according to the various sound frequencies and vibrations, making it clearer, tranquil, receptive and complete, thus increasing sensitivity and feeling. This sensitivity will help connect with the source of one's being and then one experiences yoga. This is the purpose and meaning of kirtan.

Just as there is an IQ, intelligence quotient, there is also an EQ, emotional quotient. The emotional quotient is not just confined to expressions of love and affection, compassion and charity; rather, it is expressed as sensitivity in all areas, no matter where the mind is directed to. The mind may be directed to a particular point or focus, yet there is an awareness in which the whole field is also covered. In chanting the name, one is expressing sentiments that are free from the conditioning of such external inputs or samskaras. One is expressing those sentiments to this pure being, which is one's personal God; and if purity is an expression of God, why not learn how to connect with that?

Kirtan helps to achieve a state wherein one is able to express one's feelings towards nature in its purest form. Therefore, kirtan has a prominent place in ashram life, in yogic life and in the lives of all spiritual seekers. Kirtan is yoga for the feelings.

Singing kirtan and clapping has many benefits. It improves the circulation, activates the heart, stimulates the brain centres and removes sickness, and one becomes happy and joyous. When one sings kirtan, one should participate wholeheartedly. One has to manifest the feeling and emotion to bring about a change in one's personality. Otherwise one remains the same. This is the secret of kirtan.

—Swami Niranjanananda Saraswati

Kirtan, 2004

Aim

The aim of this study was to observe the effects of singing devotional songs and repeating devotional words on different feelings and emotions.

Method

This pilot project on the effects of bhakti yoga was conducted by the department of Applied Yogic Science (AYS), Bihar Yoga Bharati (BYB), Munger, in the year 2004. Yogic lifestyle at Ganga Darshan Gurukul integrates practices of all the branches of yoga in the daily routine. In the Bihar Yoga tradition chanting of Sanskrit stotras and mantras and singing kirtan (henceforth called kirtan in this report) is practised daily for one hour in the evening at the end of the working day.

Each Post Graduate student of AYS observed four students from other faculties of BYB regarding the effects of one hour of devotional practice using a simple questionnaire designed by the department of AYS. See Appendix. The participants filled out the questionnaire before the evening session of kirtan and again just after it for seven days. A total of forty-one students participated in the study.

Parameters

Six feelings/emotional states of mind and three experiential states were observed pre and post one-hour session of kirtan.

- Peace and contentment
- Introversion
- Devotion
- Security
- Emotionality
- Positivity
- Pranic experience

- Emotional experience
- Psychosomatic experience

Results and discussion

Forty-one students from BYB, both genders, residing at Ganga Darshan formed the sample group. The changes in various parameters were quantified by comparing mean values before and after the practice. The t test showed the statistical significance of the change on a daily basis and F value showed whether over seven days the change was progressive or static.

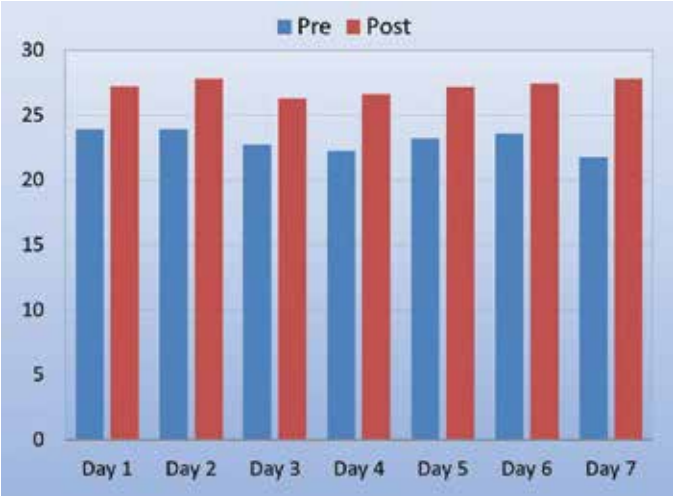
The feeling of peace and contentment was assessed using nine questions. Everyday there was significant increase in the feeling of peace and contentment after the practice. See Table 1 and the accompanying graphs. The improvement in that feeling did not increase in magnitude over seven days, the benefit was not progressive. See F value in Table 2.

The state of introversion was assessed using nine questions. Every day there was significant increase in the state of introversion after the practice. See Table 2 and the accompanying graphs. The improvement in that state did not increase in magnitude over seven days, the benefit was not progressive. See F value in Table 2.

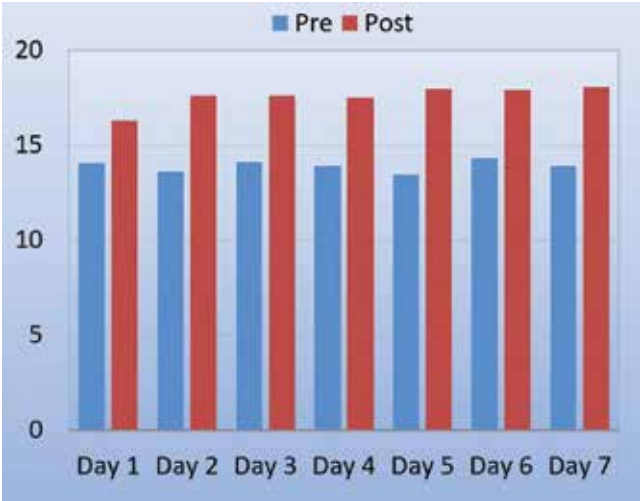
Table 1: Kirtan: peace & contentment and introversion – mean

	Peace & contentment			Introversion		
	<i>Pre</i>	<i>Post</i>	<i>t Test</i>	<i>Pre</i>	<i>Post</i>	<i>t Test</i>
<i>Day 1</i>	23.93	27.20	0.0003	14.07	16.29	0.0011
<i>Day 2</i>	23.90	27.78	0.0000	13.61	17.61	0.0000
<i>Day 3</i>	22.71	26.29	0.0001	14.12	17.61	0.0004
<i>Day 4</i>	22.24	26.63	0.0000	13.88	17.49	0.0000
<i>Day 5</i>	23.20	27.17	0.0005	13.46	17.95	0.0000
<i>Day 6</i>	23.61	27.41	0.0000	14.29	17.90	0.0000
<i>Day 7</i>	21.76	27.78	0.0000	13.90	18.05	0.0000

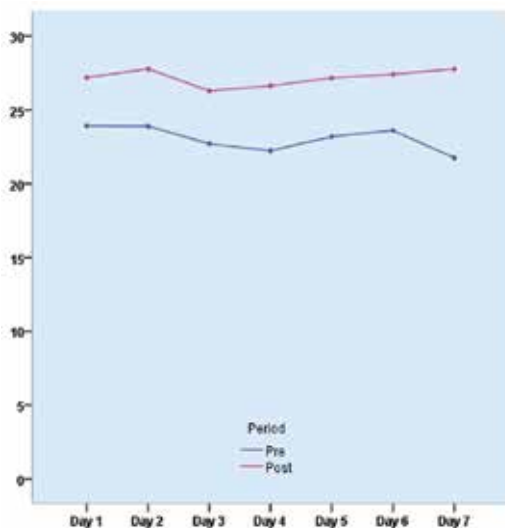
Effect of Kirtan on Peace & Contentment



Effect of Kirtan on Introversion



Effect of Kirtan on Feeling of Peace & Contentment



Effect of Kirtan on Introversion

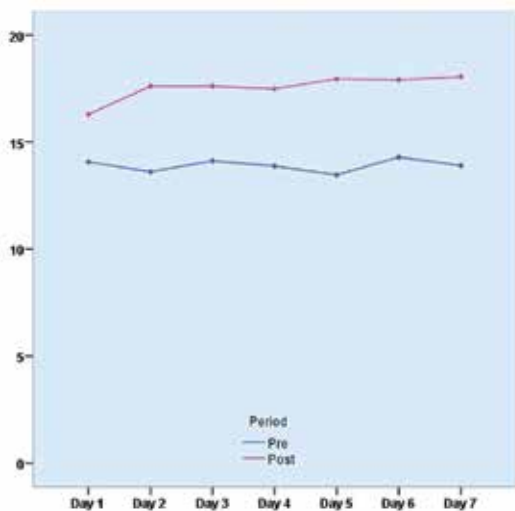


Table 2: Kirtan: peace & contentment and introversion – F statistics

		F value	Significance	Partial eta squared	Observed power
<i>Peace & contentment</i>	<i>(7 days)* (Pre-post)</i>	1.241	0.295	0.090	0.459
<i>Introversion</i>	<i>(7 days)* (Pre-post)</i>	1.115	0.362	0.082	0.414

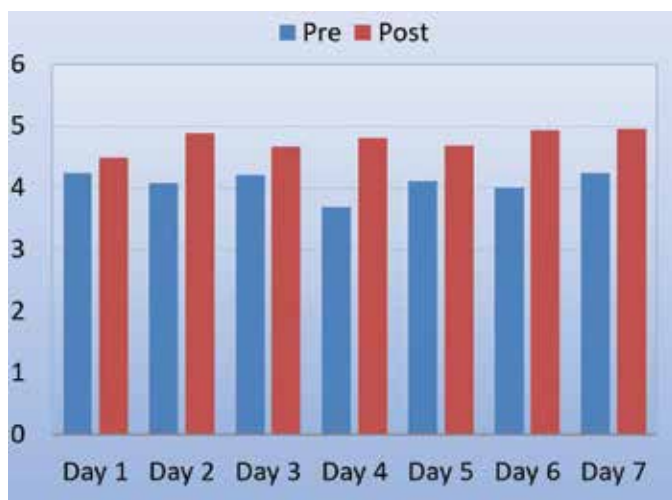
The feeling of devotion was assessed using two questions. Every day except one there was significant increase in the feeling of devotion after the practice. See Table 3 and the accompanying graphs. The improvement in that feeling did not increase in magnitude over seven days, the benefit was not progressive. See F value in Table 4.

The feeling of security was assessed using four questions. On four days out of seven there was significant increase in the feeling of security after the practice. See Table 3 and the accompanying graphs. The improvement in that feeling did not increase in magnitude over seven days, the benefit was not progressive. See F value in Table 4.

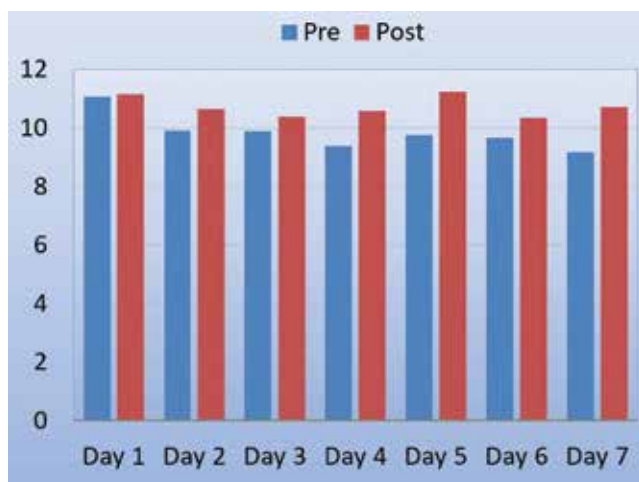
Table 3: Kirtan: devotion and security – mean value

	Devotion			Security		
	<i>Pre</i>	<i>Post</i>	<i>T Test</i>	<i>Pre</i>	<i>Post</i>	<i>T Test</i>
<i>Day 1</i>	4.24	4.49	0.3233	11.07	11.15	0.8564
<i>Day 2</i>	4.07	4.88	0.0028	9.90	10.66	0.0538
<i>Day 3</i>	4.20	4.66	0.0551	9.88	10.39	0.1177
<i>Day 4</i>	3.68	4.80	0.0004	9.39	10.59	0.0001
<i>Day 5</i>	4.10	4.68	0.0535	9.76	11.24	0.0001
<i>Day 6</i>	4.00	4.93	0.0008	9.66	10.34	0.1031
<i>Day 7</i>	4.24	4.95	0.0220	9.17	10.71	0.0001

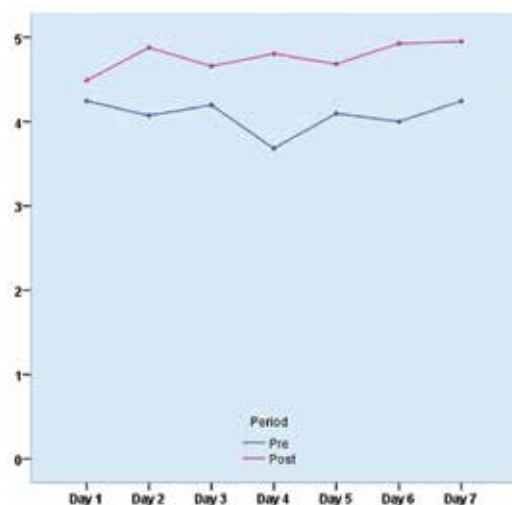
Effect of Kirtan on Devotion



Effect of Kirtan on Feeling of Security



Effect of Kirtan on Devotion



Effect of Kirtan on Feeling of Security

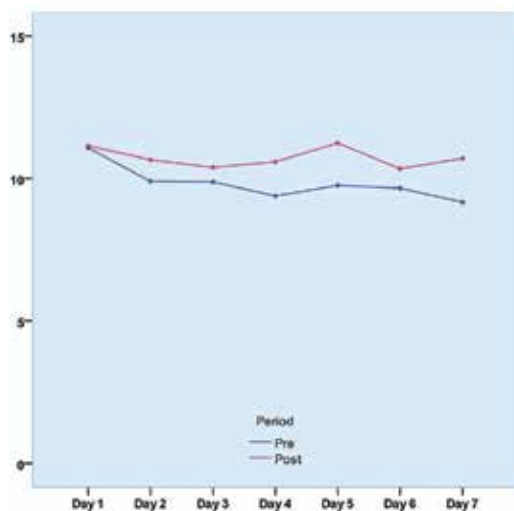


Table 4: Kirtan: devotion and security – F statistics

		F value	Significance	Partial eta squared	Observed power
Devotion	(7 days) * (Pre-post)	0.995	0.435	0.074	0.370
Security	(7 days) * (Pre-post)	1.370	0.238	0.099	0.504

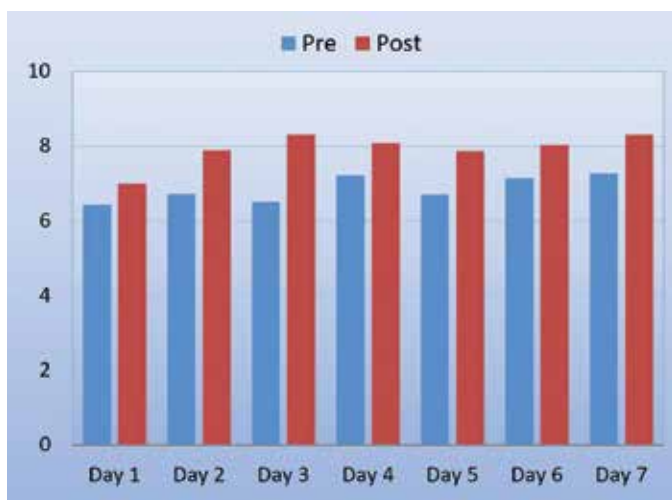
The state of emotionality was assessed using four questions. Except on one day there was significant increase in the state of emotionality after the practice. See Table 5 and the accompanying graphs. The improvement in that state did not increase in magnitude over seven days, the benefit was not progressive. See F value in Table 6.

The state of positivity was assessed using two questions. On four days out of seven there was significant increase in the state of positivity after the practice. See Table 5 and the accompanying graphs. The improvement in that state did not increase in magnitude over seven days, the benefit was not progressive. See F value in Table 6.

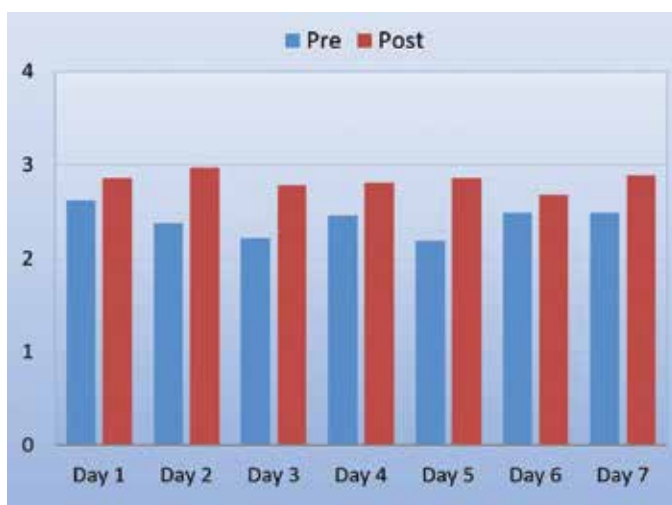
Table 5: Kirtan: emotionality and positivity – mean value

	Emotionality			Positivity		
	Pre	Post	T test	Pre	Post	T test
Day 1	6.43	7.00	0.1796	2.62	2.86	0.1931
Day 2	6.73	7.89	0.0026	2.38	2.97	0.0051
Day 3	6.51	8.30	0.0009	2.22	2.78	0.0013
Day 4	7.22	8.08	0.0305	2.46	2.81	0.1133
Day 5	6.70	7.86	0.0284	2.19	2.86	0.0050
Day 6	7.14	8.03	0.0338	2.49	2.68	0.3774
Day 7	7.27	8.30	0.0190	2.49	2.89	0.0535

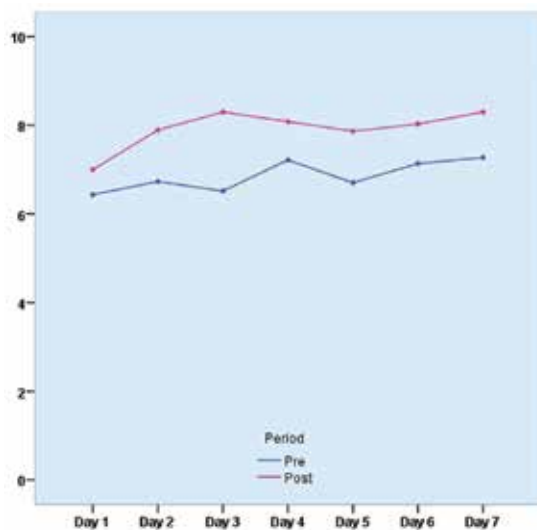
Effect of Kirtan on Emotionality



Effect of Kirtan on Positivity



Effect of Kirtan on Emotionality



Effect of Kirtan on Positivity

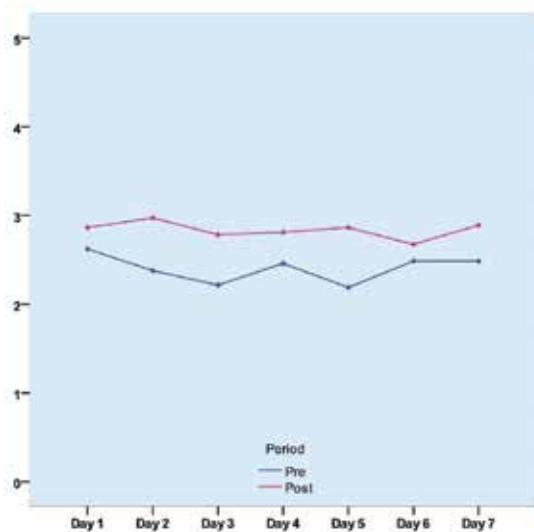


Table 6: Kirtan: emotionality and positivity – F statistics

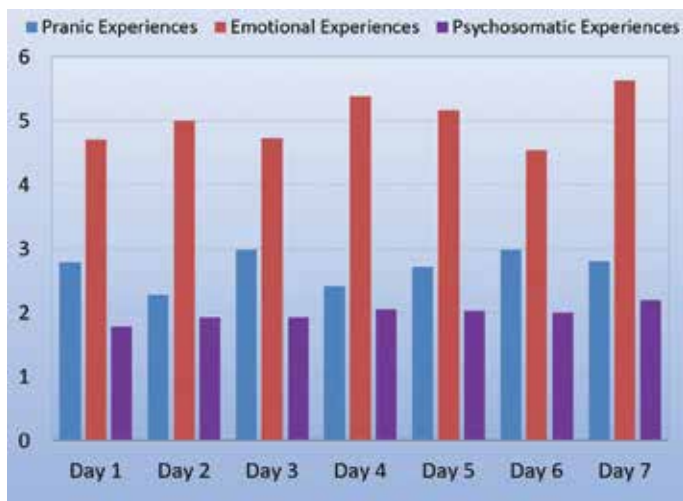
		F value	Signifi- cance	Partial eta squared	Observed power
<i>Emotionality</i>	<i>(7 days)* (Pre-post)</i>	0.765	0.600	0.064	0.282
<i>Positivity</i>	<i>(7 days)* (Pre-post)</i>	0.751	0.611	0.063	0.277

The experience in the pranic realm was assessed using two questions, the emotional experience using three and the psychosomatic using one question. They were assessed in the post questionnaire only. The magnitude of emotional experiences was highest, seconded by pranic experiences while psychosomatic were least. See Table 7 and the accompanying graphs.

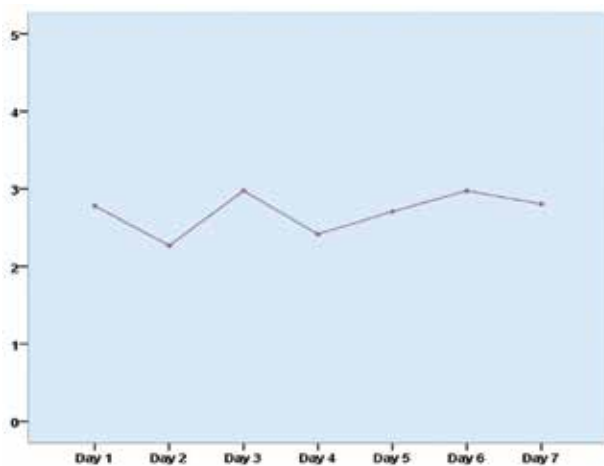
Table 7: Kirtan: pranic, emotional and psychosomatic experiences – mean value

	Pranic experience	Emotional experience	Psychosomatic experience
<i>Day 1</i>	2.78	4.71	1.78
<i>Day 2</i>	2.27	5.00	1.92
<i>Day 3</i>	2.98	4.73	1.92
<i>Day 4</i>	2.41	5.39	2.05
<i>Day 5</i>	2.71	5.17	2.03
<i>Day 6</i>	2.98	4.54	2.00
<i>Day 7</i>	2.80	5.63	2.19

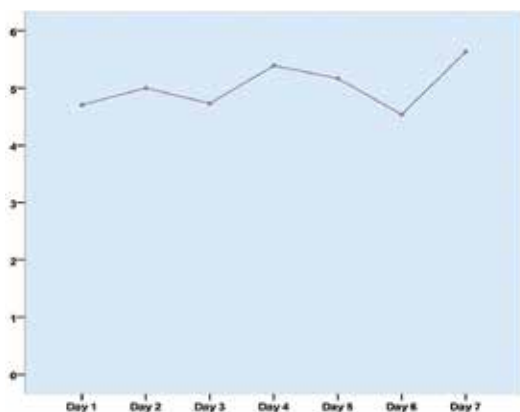
Effect of Kirtan on Subtle Experiences



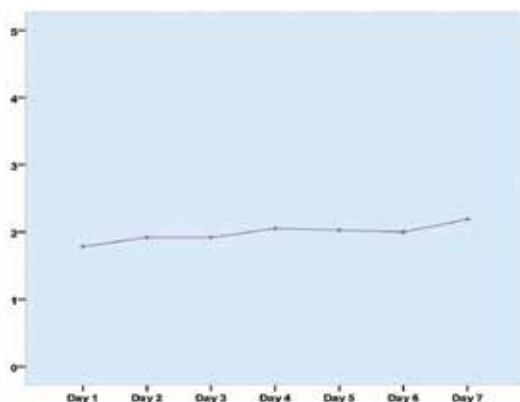
Pranic Experience after Kirtan



Emotional Experience after Kirtan



Psychosomatic Experience after Kirtan



Conclusion

The bhakti yoga practice of kirtan as practised in the Bihar Yoga tradition improves various positive states and feelings just after the practice. It also gives pranic and emotional experiences. These states, feelings and experiences are not progressive over a period of time. The pre values of the different parameters are not found to be increasing, denoting that these states, feelings and experiences do not carry over to the next day. The effects are for a short period.

Appendix A

KIRTAN QUESTIONNAIRE (Translation)

Given below are some questions to determine your current state of mind. Please rate each question according to the scale given below.

not at all	– 0
below average	– 1
average	– 2
above average	– 3
excessive	– 4

1. Which of the two nostrils is more open at present?
2. Are any thoughts crossing your mind at present?
3. Is your mind peaceful at present?
4. Is your mind lost in past memories at present?
5. Are you feeling oneness with other people at present?
6. Do you feel the need to be alone at present?
7. Is your mind lost in matters of past/future at present?
8. Are you feeling completely secure at present?
9. At the moment, do you feel that all your problems will be resolved on their own?
10. Do you feel your mind is entangled in day-to-day problems at this moment?
11. Do you feel fully inspired at this moment?
12. Do you feel that something is missing in your life at present?

13. Are you feeling emotional at present?
14. Do you feel like closing your eyes and being absorbed in yourself at this moment?
15. Is negativity present in your thoughts/emotions at present?
16. Do you feel like spending time with family and friends at present?
17. Are you feeling hesitant to express yourself at present?
18. Are you in a positive frame of mind at present?
19. Are you worried at the moment?
20. Are you feeling lonely at present?

The questions given below are to be answered only after the kirtan session.

21. Did you experience tingling, mild pain, sensation or an electric impulse in your body during kirtan?
22. Did you experience emotional outbursts such as a sudden desire to cry during kirtan?
23. Did you experience an inner spontaneous desire to dance (not because others were dancing) during kirtan?
24. Are you experiencing blissful ecstasy at present?
25. Did you experience your existence expand beyond the physical boundaries of the body during kirtan?
26. Do you feel your physical/mental problems have decreased at present?

Appendix B

KIRTAN QUESTIONNAIRE – SCORING GUIDE

Six feelings/emotional states of mind:

- Peace and contentment
- Introversion
- Devotion
- Security
- Emotionality
- Positivity

Three experiential states:

- Pranic experience
- Emotional experience
- Psychosomatic experience

Scoring scale:

not at all	– 0
below average	– 1
average	– 2
above average	– 3
excessive	– 4

Generally the answer given carries the same marking. For example, answer ‘0’ is marked 0, answer ‘3’ is marked 3 and so on. But “ve scoring” carries the opposite mark. For example, ‘0’ will be scored 4. ‘1’ will be scored 3, 2 will stay 2, ‘3’ will be scored 1 and ‘4’ will be scored 0.

+ve scoring = positive scoring

-ve scoring = negative scoring

1. Which of the two nostrils is more open at present?
No score
2. Are any thoughts crossing your mind at present?
Introversion = +ve scoring
Peace and contentment = -ve scoring
3. Is your mind peaceful at present?
Peace and contentment = +ve scoring
Introversion = +ve scoring
4. Is your mind lost in past memories at present?
Introversion = +ve scoring
5. Are you feeling oneness with other people at present?
Devotion = +ve scoring
6. Do you feel the need to be alone at present?
Introversion = +ve scoring
Peace and contentment = +ve scoring
7. Is your mind lost in matters of past/future at present?
Introversion = +ve scoring
8. Are you feeling completely secure at present?
Security = +ve scoring
Peace and contentment = +ve scoring
9. At the moment, do you feel that all your problems will be resolved on their own?
Devotion = +ve scoring
Peace and contentment = +ve scoring
10. Do you feel your mind is entangled in day-to-day problems at this moment?
Peace and contentment = -ve scoring
11. Do you feel fully inspired at this moment?
Emotionality = +ve scoring
Introversion = +ve scoring
12. Do you feel that something is missing in your life at present?
Security = -ve scoring
Peace and contentment = -ve scoring

13. Are you feeling emotional at present?
 Emotionality = +ve scoring
 Introversion = +ve scoring
14. Do you feel like closing your eyes and being absorbed in yourself at this moment?
 Introversion = +ve scoring
 Peace and contentment = +ve scoring
15. Is negativity present in your thoughts/emotions at present?
 Positivity = -ve scoring
 Peace and contentment = -ve scoring
16. Do you feel like spending time with family and friends at present?
 Introversion = -ve scoring
17. Are you feeling hesitant to express yourself at present?
 Emotionality = +ve scoring
18. Are you in a positive frame of mind at present?
 Positivity = +ve scoring
19. Are you worried at the moment?
 Security = -ve scoring
20. Are you feeling lonely at present?
 Security = -ve scoring
 Emotionality = +ve scoring

The questions given below are to be answered only after the kirtan session.

21. Did you experience tingling, mild pain, sensation or an electric impulse in your body during kirtan?
 Pranic experience = +ve scoring
22. Did you experience emotional outbursts such as a sudden desire to cry during kirtan?
 Emotional experience = +ve scoring
23. Did you experience an inner spontaneous desire to dance (not because others were dancing) during kirtan?
 Emotional experience = +ve scoring
24. Are you experiencing blissful ecstasy at present?
 Emotional experience = +ve scoring

25. Did you experience your existence expand beyond the physical boundaries of the body during kirtan?
Pranic experience = +ve scoring
26. Do you feel your physical/mental problems have decreased at present?
Psychosomatic experience = +ve scoring

KIRTAN QUESTIONNAIRE (Original)

कीर्तन

प्रश्नावली

YOGA RESEARCH FOUNDATION

Questionnaire ©

Basic Research K Q.No.1

Sub Code No. _____ Date: _____



आपका वर्तमान मनोस्थिति की जानकारी के लिये कई प्रश्न यहाँ पूछे गये हैं। कृपया नीचे दिये गये पाँच विकल्पों में से एक का चुनाव करें और सही अंक को अंकतालिका में अंकित करें।

बिलकुल नहीं 0 ; थोड़ा/कम 1 ; साधारण/मध्यम 2 ; ज्यादा 3 ; अतिशय 4

1. अभी आप का कौन सा नासिका द्वार ज्यादा खुला हुआ है?
 2. क्या अभी आप के मन में विचार चल रहे हैं?
 3. क्या अभी आप का मन शांति का अनुभव कर रहा है?
 4. क्या अभी आप का मन विगत स्मृतियों में खोया हुआ है?
 5. क्या अभी आप दूसरे लोगों से अपनेपन का भाव अनुभव कर रहे हैं?
 6. क्या अभी आप को एकांत की इच्छा हो रही है?
 7. क्या अभी आप का मन भूत/भविष्य की बातों में उलझा हुआ है?
 8. क्या अभी आप स्वयं को पूर्णतः सुरक्षित महसूस कर रहे हैं?
 9. क्या अभी आप को लगता है कि जीवन की सारी परेशानियाँ अब स्वतः दूर हो जायेगी?
 10. क्या अभी आप अपने मे को दैनिक उलझनों में फँस हुआ अनुभव कर रहे हैं?
 11. क्या अभी आप स्वयं का प्रण स भरा हुआ अनुभव कर रहे हैं?
 12. क्या अभी आप अपने जीवन में कोई कमी अनुभव कर रहे हैं?
 13. क्या अभी आप स्वयं में भावुकता अनुभव कर रहे हैं?
 14. क्या अभी आप नेत्रों को बंद कर स्वयं में रमे रहना चाहते हैं?
 15. क्या अभी आप के विचारों/भावों में नकारात्मकता है?
 16. क्या अभी आप को अपने परिवार/मित्रों के साथ समय बिताने की इच्छा हो रही है?
 17. क्या अभी आप अपने को व्यक्त करने में हिचकिचाहट अनुभव कर रहे हैं?
 18. क्या अभी आप अपनी वर्तमान मनोस्थिति(मुड) को सकारात्मक पाते हैं?
 19. क्या अभी आप चिन्तित हैं?
 20. क्या अभी आप अकेलापन का अनुभव कर रहे हैं?
- निम्नलिखित प्रश्नों के उत्तर केवल कीर्तन के बाद ही देने हैं।
21. क्या कीर्तन के दौरान आपको झुनझुनाहट, हल्का दर्द, गर्मी का प्रवाह या बिजलीके करंट जैसा अनुभव हुआ?
 22. क्या कीर्तन के दौरान अचानक ही रने की इच्छा जैसे भावनात्मक आवेश अनुभव हुए?
 23. क्या कीर्तन के दौरान नाचने की आंतरिक इच्छा(दूसरों को देखकर नहीं) हो रही थी?
 24. क्या अभी आप तृप्तिमय आनंद का अनुभव कर रहे हैं?
 25. क्या कीर्तन के दौरान अपने अस्तित्व को विस्तीर्ण(शरीर को वास्तविक परिधि से भी फैला हुआ) अनुभव किया?
 26. क्या अभी आप अपनी शारीरिक/मानसिक व्याधि में कमी महसूस कर रहे हैं?



Yoga does not go by beliefs; it goes by investigations and discoveries. I want to develop the scientific side of yoga with the help of open-minded examiners and investigators because yoga science has much to contribute to the good of humanity.

I am absolutely sure about it. It is science, scientists, and scientific thinking which will preside over the destiny of humankind, and this science will recognize the potential of yoga for humanity.

—Swami Satyananda Saraswati

Volume Four of Yoga Research Foundation presents research related to the application of yoga, promotion of health and basic research. The majority of studies did not come to any conclusive results, however, it is of interest to know the variety of factors which determine a successful study. This volume is as much dedicated to the subjects of investigation, such as adolescence, diabetes, shatkarmas and asanas, as to the research design and execution. It is meant to inspire and encourage yoga practitioners and yoga teachers to explore the countless benefits of yoga.



ISBN : 978-81-940805-5-8